San Juan River Basin Recovery Implementation Program

Fiscal Year 2003 Annual Budget and Work Plan

Approved

November 7, 2002

San Juan River Basin Recovery Implementation Program

FY 2003 Work Plan

Approved 11/07/02

Final 2003 Work Plan Table

Page #	Title	Agency	Program	Other Direct	Total	Base or Capital
A. Monitoring						
A-1	Adult/Juvenile Fish Community Monitoring	FWS, GJ	$ 59,740		$ 59,740	B
A-5	YOY/Small Bodied Fish Monitoring	NMDGF	$ 49,775		$ 49,775	B
A-9	Colorado Pikeminnow Larval Fish Collecting	UNM, NMDGF	$ 49,800		$ 49,800	B
A-15	Larval Razorback Sucker Survey	UNM, NMDGF	$ 45,650		$ 45,650	B
A-21	Specimen Curation/Identification	UNM	$ 27,600		$ 27,600	B
A-25	Channel Morphology	KB	$ 107,169		$ 107,169	B
A-29	Habitat Mapping	KB/ERI	$ 83,087		$ 83,087	B
A-31	Water Temperature Monitoring	KB	$ 7,690		$ 7,690	B
A-33	Water Quality Monitoring	KB	$ 27,687		$ 27,687	B
A-37	Polynuclear Hydrocarbon Study	BLM		$ 50,000	$ 50,000	B
A-43	Update and Maintenance of GIS Database	UNM/KB	$ 102,750		$ 102,750	B
A-49	Summary of Monitoring Activities	BIO-WEST	$ 15,000			
	subtotal		**$ 575,948**	**$ 50,000**	**subtotal $ 625,948**	

Final 2003 Work Plan Table

Page #	Title	Agency	Program	Other Direct	Total	Base or Capital
B. Peer Review						
B-1	Peer Review	BIO/WEST	$ 22,000		$ 22,000	B
	subtotal		**$ 22,000**		**subtotal $ 22,000**	
C. Research Activities						
C-1	Population Model Maintenance	ERI/MEC	$ 20,268		$ 20,268	B
C-3	Characterization of Razorback Spawning Bar	KB/ERI	$ 47,922		$ 47,922	B
C-7	Navajo/San Juan Temperature Model	BR	$ 23,640		$ 23,640	B
C-13	Assessment of Fish Movement at Hogback	FWS, Abq.	$ 24,840		$ 24,840	B
C-19	Trophic Relationships Among Colorado Pikeminnow and Its Prey in the San Juan River	NMDG&F, KSU	$ 53,000		$ 53,000	B
C-31	Assessment of Colorado Pikeminnow Augmentation	BIO-WEST, NMDG&F, UNM	$ 88,675		$ 88,675	B
	subtotal		**$ 258,345**		**subtotal $ 258,345**	

Final 2003 Work Plan Table

Page #	Title	Agency	Program	Other Direct	Total	Base or Capital
D. Recovery Efforts						
D-1	Nonnative Species Control	FWS, Abq	$ 136,880		$ 136,880	B
D-5	Nonnative Species Control - Lower San Juan	UDWR and others	$ 84,660		$ 84,660	B
D-9	Razorback Sucker Augmentation (includes $20,000 for pit tags)	FWS, G.J.	$ 69,640		$ 69,640	B/C
D-15	Radio Tracking of Stocked Adult Colorado Pikeminnow	FWS, G.J.	$ 37,260		$ 37,260	B
D-19	Colorado Pikeminnow Fingerling Production	FWS/DNFHTC	$ 65,090		$ 65,090	B
D-23	Stocking of Fingerling Colorado Pikeminnow	FWS, G.J.	$ 11,040		$ 11,040	B
D-27	Interim Holding Facility for Larval Razorback Sucker	UNM	$ 17,510		$ 17,510	C
D-33	Razorback Sucker Pond Linmological Study	ERI/BIA	$ 47,209		$ 47,209	B
	subtotal		**$ 469,289**	**$ 0**	**subtotal $ 469,289**	

Final 2003 Work Plan Table

Page #	Title	Agency	Program	Other Direct	Total	Base or Capital
E. Hydrology Committee						
E-1	Completion of the 3rd Generatioin Model	BR	$ 54,500		$ 54,500	B
E-3	Maintenance & Operation of Model	BR	$ 77,500		$ 77,500	B
E-5	Improve Stream Gaging	BR	$ 25,000		$ 25,000	B
	Subtotal		**$ 157,000**		**$ 157,000**	
F. Program Coordination and Management						
F-1	Program Coordination	FWS, Abq	$ 129,840		$ 129,840	B
F-3	Program Management	BR	$ 50,000		$ 50,000	B
	subtotal		**$ 179,840**	**$ 0**	**subtotal $ 179,840**	

Final 2003 Work Plan Table

Page #	Title	Agency	Program	Other Direct	Total	Base or Capital
G. Capital Projects and Management						
G- 1	Capital Projects Management	BR	$ 91,000		$ 91,000	C
G-3	PNM Fish Passage	BR	$ 125,000		$ 125,000	C
G-5	Operation of PNM Fish Passage	BIA	$ 42,000		$ 42,000	B
G-11	Rearing Ponds		$ 405,000		$ 405,000	C
	Hogback and Cudei Reimbursement					
	subtotal		**$ 663,000**	**$ 0**	**subtotal $ 663,000**	

Final 2003 Work Plan Table

Summary

Category	Program Base Funds	Program Capital Funds	Agency Funds	Total Funds
A. Monitoring	$ 575,948		$ 50,000	$ 625,948
B. Peer Review	$ 22,000			$ 22,000
C. Research Activities	$ 258,345			$ 258,345
D. Recovery Efforts	$ 431,779	$ 37,510		$ 469,289
E. Hydrology	$ 157,000			$ 157,000
F. Program Coordination and Management	$ 179,840			$ 179,840
G. Capital Projects	$ 42,000	$ 621,000		$ 663,000
Total Program Budget Proposals	**$ 1,666,912**	**$ 658,510**	**$ 50,000**	**$ 2,375,422**

MONITORING

Adult/Juvenile Fish Community Monitoring
Fiscal Year 2003 Project Proposal

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Background:

Studies performed before 1991 documented a native San Juan River fish fauna of eight species, including Colorado pikeminnow (previously known as Colorado squawfish), razorback sucker, and roundtail chub and provided baseline information on distribution and abundance of native and introduced fish species in the San Juan River. Main channel fish community monitoring studies (known as "adult monitoring") performed from 1991 to 2001 refined this baseline data and provided data on specific habitat usage by rare fish species. Adult monitoring proved to be a highly effective tool for monitoring populations of stocked razorback sucker and Colorado pikeminnow. Information gathered during adult monitoring also aided in the selection of specific sites for detailed hydrologic measurements and larval drift sampling. Integration of adult monitoring data with data from Colorado pikeminnow macrohabitat studies, razorback sucker experimental stocking studies, tributary and secondary channel studies, fish health studies, contaminants studies, habitat mapping studies, and non-native species interaction studies, helped provide data to make flow recommendations for reoperation of Navajo Reservoir.

Intensive electrofishing surveys conducted from 1991 to 2001 greatly expanded our knowledge on the distribution and abundance of the San Juan River fish community. As of October 2001, nineteen wild Colorado pikeminnow (two juveniles and 17 adults) have been collected and PIT-tagged; 13 of the 19 Colorado pikeminnow were radio-tagged. In addition, 15 adult and over 200 juvenile stocked Colorado pikeminnow have been recaptured (95 of these fish were captured on the October 1998 adult monitoring trip). Thirty-two roundtail chub were collected, 23 of these were PIT-tagged. No wild razorback sucker were collected, however over 100 recaptures (including multiple recaptures of individual fish) of stocked razorback sucker have occurred during adult monitoring trips. The 2002 adult monitoring trip is scheduled for late September through early October 2002. This trip is already funded via FY-2002 funds.

The need for a long-term, standardized monitoring program, such as the adult monitoring study, is addressed in objective 5.7.1, a Milestone in the San Juan River Long Range Plan. Additionally, future monitoring will help determine fish community response to reoperation flows from Navajo Dam (objective 5.2.10), as well as monitoring both wild and augmented populations of Colorado pikeminnow and razorback sucker (objective 5.3.9).

Adult monitoring will continue with one trip in fall 2003, to measure fish community response to reoperation flows from Navajo Dam, monitor populations of stocked Colorado pikeminnow and razorback sucker, and assess the impacts of management actions (e.g., nonnative fish removal efforts) on native fish species. In support of objective #4 below, nonnative fish removal will continue to be done on adult monitoring trips. The study design for adult monitoring is based upon the criteria for long-term monitoring of the San Juan River main channel fish community. These criteria were accepted as final by the San Juan River Biology Committee on 31 March 2000.

Description of Study Area:

The study area for adult monitoring extends from river mile (RM) 180.0 (Animas River confluence) in Farmington, New Mexico, downstream to RM 2.9 (Clay Hills Landing) just above Lake Powell in Utah. The entire reach of river from RM 180.0 to RM 2.9 will be sampled in the fall of every year (sampling to begin in the second to third week of September).

Objectives:

1.) Monitor the large-bodied species of the San Juan River fish community in order to determine shifts in community structure (e.g., abundance and distribution, length/weight frequencies) under the reoperation flow regime.

2.) Monitor wild Colorado pikeminnow population trends.

3.) Monitor experimentally stocked razorback sucker and Colorado pikeminnow (growth rates and dispersal patterns).

4.) Remove nonnative fish species which prey upon and compete with native fish species in the San Juan River.

Methods:

Objectives 1-5: One adult monitoring trip will take place in fall 2003. This trip will sample from the Animas River confluence in New Mexico (RM 180.0) to Clay Hills Landing in Utah (RM 2.9). Electrofishing will be the primary sampling technique, although seining and trammel netting may also be employed.

Two oar-powered rafts, with one netter each, will electrofish in a continuous downstream fashion, with one raft on each shoreline. No outboard motors will be used. Sampling crews will consist of approximately 8-9 people (4 for electrofishing, 2 for baggage rafts, and 2-3 for other research elements that are being done simultaneously with our sampling). Electrofishing will sample two out of every three miles (approximately 120 total sampled miles). All fish collected will be enumerated by species and life stage every sampled mile. Every fifth sampled mile (dubbed a "designated mile" or DM), all fish collected will be weighed and measured. All native fish collected will be returned alive to the river. All nonnative fish collected will be removed from the river. All predatory lacustrine fishes (i.e. - walleye, striped bass, largemouth bass,

smallmouth bass) collected will be weighed, measured, and have stomach contents taken, before being removed from the river. Tag numbers, total length, and weight will be recorded on all recaptured, FLOY-tagged fish (both native and nonnative), as well as any rare fish collected. Colorado pikeminnow, razorback sucker, and roundtail chub greater than 200 mm TL will be implanted with PIT (Passive Integrated Transponder) tags. Notes will be kept on any parasites and/or abnormalities observed on collected fishes.

Electrofishing will follow the methods set forth above and in the long-term monitoring plan. Seining and trammel netting may be done where suitable habitat is available at the sampling crews' discretion. The Service will have the lead for adult monitoring trips and other cooperating agencies will provide personnel and equipment as needed. Costs for cooperating agencies are included in this budget.

Products:

An interim progress report for adult monitoring data collected during 2003 is scheduled to be available by 31 March 2004. The "draft final" of this interim progress report which incorporates comments received, is scheduled to be completed by 1 June 2004. DBASE IV files containing information on total catch and length/weight data gathered on adult monitoring trips will be submitted to Keller-Bliesner Engineering for inclusion on the San Juan River Recovery Implementation Program integrated database CD-ROM by 31 March 2004.

Fiscal Year 2003 Budget:

Personnel	
Objectives 1-4 (110 man days): logistics, electrofishing, removal of nonnative fish	$23,300
Subtotal	$23,300
Travel and Per Diem (32 days)	$ 6,750
Data Analysis and Reporting (45 days)	$ 9,400
Subtotal	$16,150
Equipment and Supplies--i.e., fuel and maintenance, repair, replacement of:	
Field equipment: nets, PIT tag gear, rafts, generators, electrofishing equipment, trucks, camping equipment, etc. ***	$ 2,000
Total	$41,450
Service Administrative Overhead (20.00%)	$ 8,290
U.S. Fish and Wildlife-CRFP Total	$49,740
Funding for participation of other agencies:	
New Mexico Dept. of Game and Fish-Santa Fe	$ 3,000
U.S. Fish and Wildlife Service-Albuquerque	$ 3,000
Utah Division of Wildlife Resources-Moab	$ 4,000
Subtotal	$10,000
GRAND TOTAL	**$59,740**

*** The 'Equipment and Supplies' costs listed here represent the costs anticipated to be incurred by CRFP in FY-2003 for performing our own field work as well as providing equipment for other agencies (UDWR-Moab and USFWS-Albuquerque) with whom we are cooperating on approved SJRIP projects. Our total anticipated cost for 'Equipment and Supplies' in FY-2003 (i.e. $6,000) has been divided evenly and distributed across three CRFP workplans, of which this workplan is one.

Previous Years' Funding:

Fiscal Year 1998	$50,000	Fiscal Year 1999	$43,900
Fiscal Year 2000	$43,900	Fiscal Year 2001	$54,400
Fiscal Year 2002	$58,000		

Estimated Outyear Funding (based on an annual 5% increase as agreed upon by the SJRIP Biology Committee at their 21 May 2002 meeting):

Fiscal Year 2004	$62,750	Fiscal Year 2005	$65,860
Fiscal Year 2006	$69,150	Fiscal Year 2007	$72,600
Fiscal Year 2008	$77,700		

YOY/Small Bodied Fish Monitoring
Fiscal Year 2003 Project Proposal

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Background:

As set forth in Section 5.7 of the San Juan River Basin Recovery Implementation Program (SJRIP) Long-Range Plan, a long-term monitoring program "to identify changes in the endangered and other native species populations, status, distributions and habitat conditions" was to be developed by the SJRIP Biology Committee. The ichthyofaunal monitoring portion of the San Juan River Monitoring Plan and Protocols (Propst, et al., 2000) was divided into four primary areas, larval fish (drift sampling), larval fish (seining), young-of-year/small bodied, and subadult and adult/large-bodied fishes. The portion of the San Juan River to be monitored extends from the confluence of the Animas and San Juan rivers (Farmington) to Lake Powell (Clay Hills Crossing). The following work proposal for 2003 is to conduct the young-of-year/small-bodied fishes monitoring effort per protocols set forth in the San Juan River Monitoring Plan and Protocols (SJRMPP).

In addition to accomplishing work (field, laboratory, data analysis, and report writing) specific to the young-of-year/small-bodied fish monitoring effort, NMGF personnel participate in telemetry studies, native-nonnative interaction study, and larval fish sampling of the San Juan River Basin Recovery Implementation Program. This work and budgeting for NMGF participation in these activities is included with Scopes of Work for each activity and submitted by Principal Investigator(s) for each.

Study Area:

The study area for YOY/small bodied fish monitoring extends from river mile RM 180.0 (Animas River confluence) in Farmington, New Mexico, downstream to RM 2.9 (Clay Hills Crossing) just above Lake Powell in Utah.

Collections:

Specimens collected will be inspected to determine if any rare fishes (Colorado pikeminnow, roundtail chub, and razorback sucker) are present in a sample or collection. All identifiable rare fish and all large- bodied native fish (i.e., flannelmouth and bluehead suckers) >150 mm TL will be released. All other specimens will be preserved in 10% formalin and returned to the New Mexico Department of Game and Fish Laboratory for identification, enumeration, and measurement (total length and mass).

Objectives:

The objectives of this portion of the San Juan River monitoring effort are to obtain data that will aid in the evaluation of the response (e.g., reproduction, recruitment, and growth) of native and nonnative fishes to different flow regimes and other management actions (e.g., impediment modification), track trends in species populations (e.g., abundance and relative condition) and characterize patterns of habitat use. The data will also be available to all researchers and may be used in conjunction with data obtained in other studies to evaluate future management activities.

Methods:

The study reach (Farmington to Clay Hills Crossing) includes geomorphic reaches 6 through 1, with Reach 1 being the most downstream. As stated in SJRMPP, sampling will occur every third mile within the study reach. Secondary channels are defined as channels having less than 25% of the volume of flow at the time of sampling and are at least 300 m in length. Inflow at the top of a channel is not necessary for it to be classified as a secondary channel. If any portion of a secondary channel (except mouth) is within a designated sample mile, the secondary channel will be sampled. Young-of-year/small-bodied fish monitoring will occur in conjunction with the large-bodied fish monitoring effort. All secondary channels in each third-mile will be sampled. Primary channel shoreline habitats will be sampled in 3-mile increments. Field work will be accomplished in autumn (late-September through mid-October) and involves one foray through each of three macro-reaches (Farmington-Shiprock, Shiprock-Four Corners, and Four Corners-Cray Hills Crossing).

Primary channel and secondary channel sampling sites will be within the same river mile. In addition to structured primary channel sampling, all backwaters and embayments (>25 m^2) associated with the primary channel within each third-mile will be sampled.

Sample sites within secondary channels will be a sufficient distance from the inflow to and outflow from the secondary channel to minimize primary channel faunal and physiochemical influences. Secondary channel sample sites will be at least 100 and not more than 200 m in length. All mesohabitats (e.g., pool, riffle, riffle-eddy, and shoal) within the site will be sampled in approximate proportion to their availability within the site; typically, at least five mesohabitat types will be sampled in each secondary channel. Each mesohabitat will be sampled separately with 3.2 x 1.6 m (4 mm mesh) drag seines. Each secondary channel sampling effort will be a minimum of 5 seine hauls. The number of seine hauls, total area (m^2) seined, and types of mesohabitats sampled will be recorded on standard field forms. Specimens collected in each mesohabitat will be inspected to determine if any rare fishes (Colorado pikeminnow, roundtail chub, and razorback sucker) are present in the seine. If a rare fish is captured, it will be identified, total length (±1.0 mm) and mass (±1.0 g) determined, and released. Any rare fish >150 mm TL will be scanned to determine presence of a PIT tag. If none is present, the specimen will be implanted with a PIT tag having a unique alphanumeric code. All pertinent data (i.e., total and standard lengths, mass, PIT tag code, mesohabitat, water depth, substrate, and cover) on rare fish captured will be recorded. All large-bodied native fish (i.e., flannelmouth and bluehead suckers) will be weighed, measured, and released. All other specimens will be preserved in 10% formalin and returned to the New Mexico Department of Game and Fish Laboratory for identification, enumeration, and measurement (total length and mass). Field collection number, habitat number, and river mile will be recorded on a water-proof label and placed in each specimen container. Location of site (UTM) will be determined with a GPS unit. Identification of all retained rare

fishes will be confirmed by personnel of the Museum of Southwestern Biology. Preserved specimens will be accessioned to the New Mexico Department of Game and Fish Collection of Fishes or the University of New Mexico Museum of Southwestern Biology.

Within each third-mile, shoreline habitats of the primary channel will be sampled. At each designated mile, all mesohabitats (e.g., riffle, debris pool, and shoal) along 200 m (near center of mile) of shoreline will be sampled. All mesohabitats present will be sampled in approximate proportion to their availability within the site. Regardless of the number of mesohabitats present at a primary channel site, at least 5 seine hauls will be made with a drag seine (3.2 x 1.6 m, 4 mm mesh). The shoreline (river right or left) sampled will be dependent upon accessibility of the shoreline. Where more than one shoreline is accessible (and can be seined efficiently), that with greater habitat diversity/complexity will be sampled. Location (UTM) will be determined with a GPS unit. Specimen and habitat data will be obtained and recorded as required for secondary channel sampling. All retained specimens from primary channel sampling will be preserved separately from the adjacent secondary channel collection. All retained specimens will be accessioned to the New Mexico Department of Game and Fish Collection of Fishes or the University of New Mexico Museum of Southwestern Biology.

Backwaters and embayments (>25 m^2) not located within structured primary channel sampling sites also will be sampled. During periods of low flow, secondary channel mouths frequently function as backwaters or embayments. In this monitoring effort, secondary channel mouths without surface inflow from upstream will be treated as backwater/embayment habitat. The maximum number of backwaters or embayments sampled will be one per mile. Three seine hauls will be made in each backwater or embayment sampled. All specimens collected, except rare fishes, will be retained and returned to the laboratory for identification and enumeration. All rare fish will be measured and released; those >150 mm will be PIT tagged. Data collection and recording of relevant information (including GPS determined location) will be the same as for secondary and primary channels.

Ambient temperature and water quality data (water temperature, dissolved oxygen, conductivity, and salinity) will be measured in each sampled secondary channel, at primary channel sites and in backwaters/embayments. Secondary channel water quality data will be obtained a sufficient distance from the inflow to the secondary channel to minimize primary channel influences. All water quality data for each sample will be recorded on standard field forms.

Products:

Data collected during the 2003 monitoring effort will be summarized by geomorphic reaches. Minimally, the annual report will report density per species (number/m^2) per geomorphic reach, size-structure of commonly-collected species populations by geomorphic reach, and rare fishes and the mesohabitats each was found in. Data obtained from secondary and primary channel sampling will be reported separately. Backwater and embayment data will be reported in the primary channel portion of the annual report. Community-comparison metrics, such as the Shannon-Wiener Index and Morisita's Index of Diversity, will be used for longitudinal and annual comparisons. River discharge data (Four Corners gage) will be used to assess the effect of discharge volume on species density estimates. All data obtained during 2003 monitoring activities will be electronically recorded in a format to be determined by the SJRIP Biology Committee. The annual report (including electronic database) will be submitted to the SJRIP Biology Committee by 31 March 2003.

Literature Cited:

Propst, D.L., S. P. Platania, D.W. Ryden, and R. Bliesner. 2000. San Juan River Monitoring Plan and Protocols. San Juan Basin Recovery Implementation Program. U.S. Fish and Wildlife Service, Albuquerque, NM.

Budget[1]:

Young-of-year/small-bodied Monitoring (Field)	
Personnel (32 man days)	$8,000
Travel and per diem	3,000
Specimen sorting and identification, specimen curation, and data compilation	
Personnel (64 man days)	16,000
Annual small-bodied/YOY data synthesis, analysis, and report preparation	
Personnel (40 man days)	10,000
Administrative Support (10 man days)	2,000
Subtotal	$39,000
Report reviews and integration (e.g., annual & Long Range Plan) and meeting attendance (per diem only)	
Personnel (15 man days)	3,750
Travel and Per Diem	1,500
Administrative Support (5 man days)	1,000
Subtotal	$6,250
TOTAL	$45,250
Indirect Costs (10%)	4,525
GRAND TOTAL	**$49,775**

[1]Budget does not include in-kind contributions of about $22,000 per year in salary and benefits. In-kind includes field time, data analysis and report preparation, meeting attendance, and administration.

Outyear Funding (based on 5% annual cost of living increases):

Fiscal Year 2000	$57,200
Fiscal Year 2001	51,700
Fiscal Year 2002	51,700
Fiscal Year 2003	**49,775**
Fiscal Year 2004	52,275
Fiscal Year 2005	54,875
Fiscal Year 2006	57,625
Fiscal Year 2007	60,525

San Juan River Colorado Pikeminnow Larval Fish Collecting Effort
Fiscal Year 2003 Project Proposal

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Background:

Beginning in spring 1995, personnel from the Division of Fishes, Museum of Southwestern Biology (MSB), at the University of New Mexico assumed responsibility for the San Juan River larval fish passive drift-netting study. This project, formerly conducted by the Utah Division of Wildlife Resources, continued throughout 2001 with only minor changes in sampling protocol. Data collected from this research activity provided several discrete types of information on the fishes of the San Juan River. Data that can be obtained on the endangered fishes of the river include determining approximate spawning period, identifying approximate location of spawning sites, and assessing effects of annual hydrology (and temperature) on their reproductive activities. Similar data could also be obtained for other members of the ichthyofaunal community and contrasted with previously drift-net sampling to assess the effects of that year's flow regime on fish reproduction. Samples collected during this research program were processed and curated by Fish Division personnel at the University of New Mexico.

Between 1993-2000, a total of five larval Colorado pikeminnow were collected. The two YOY Colorado pikeminnow collected in 1993 (at Mexican Hat) were the same length (9.2 mm TL; MSB 18098, 18099) and were taken on consecutive days in late July (26-27). From these two individuals, we determined the date of spawning to be about 8-9 July 1995.

Two larval Colorado pikeminnow were taken at Mexican Hat during the 1995 larval fish passive drift-netting study. The first specimen, 9.5 mm TL mesolarvae (MSB 26187) was taken between 2114-2310 hours on 2 August 1995. The next morning (3 August 1995) between 0531-0800 hours, a second Colorado pikeminnow, 9.0 mm TL mesolarvae (MSB 26191) was collected. The similar size and developmental stage of these two individuals, in combination with the fact that the two fish were collected within 12 hours of each other, strongly suggest that they were cohorts from a spawning event. From these two individuals, a spawning date (between 15-17 July) was determined.

A single YOY Colorado pikeminnow was collected in 1996. That specimen was an 8.6 mm TL yolked-mesolarvae taken on 2 August 1996 in a drift net at the Mixer sampling locality (RM 128.0). That individual represents the only larval Colorado pikeminnow collected during drift net sampling at the Mixer. The 1996 back-calculated spawning date for Colorado pikeminnow (18 July 1996) was similar to that predicted in 1995 despite considerable difference in spring peak discharge (1995 - 12,100 cfs; 1996 - 3,450 cfs) and total annual discharge.

Table 1. Summary of larval and YOY Colorado pikeminnow collected in the San Juan River during larval drift-netting (1993-1998) and back-calculated dates of spawning.

Field Number	MSB Catalog Method Number	Number specimen.	Total Length	Date Collected	Date Spawned	River Mile	Sample
MH72693-2	18098	1	9.2	26 Jul 93	08 Jul 93	53.0	drift netting
MH72793-2	18099	1	9.2	27 Jul 93	09 Jul 93	53.0	drift netting
JPS95-205	26187	1	9.2	02 Aug 95	15 Jul 95	53.0	drift netting
JPS95-207	26191	1	9.0	03 Aug 95	17 Jul 95	53.0	drift netting
WHB96-037	29717	1	8.6	02 Aug 96	18 Jul 96	128.0	drift netting
TOTAL		5					

There have not been any additional non-stocked larval Colorado pikeminnow collected in the drift since August 1996. In 1998, less than 600 specimens were collected during a year replete with intense summer rainstorm events. These flushing flows transported considerable detritus into the river and overwhelmed drift collecting gear with debris. This excessive amount of debris required two years before all samples could be processed and fish separated from debris and identified. The sampling conducted in 1999 occurred during an extremely low flow year, which was reflected in the collection of a very limited number of drifting larval fish (only 84 at Four Corners and 79 at Mexican Hat). Conversely, 2000 was a Amore normal@ flow year resulting in the collection of over 2,100 specimens (1,370 at Four Corners and 768 at Mexican Hat). No Colorado pikeminnow were collected in drift studies during these years (1998-2000). Unfortunately, the 2001 sampling period was almost identical to that experienced in 1998 resulting in the collection of a massive amount of debris that will likely require two-years to process.

The limited number of wild adult San Juan River Colorado pikeminnow (versus stocked individuals) is reflective in the extremely low catch rate of larval Colorado pikeminnow. However, numerous adult and sub-adult pikeminnow have been stocked into the San Juan River over the last five years in an effort to augment the diminished population. The Colorado pikeminnow augmentation plan calls for continued stocking efforts in the San Juan River over the next 10 years. The Biology Research Team expects, as was documented with stocked razorback sucker, that reproduction among stock pikeminnow will occur and can be documented

through the sampling of larval fish. There are no means to differentiate between native versus stocked larval Colorado pikeminnow.

As the number of adult (reproductively mature) Colorado pikeminnow in the San Juan River increases (due to both stocking and recruitment), so does the probability of elevated levels of spawning by this species. The San Juan River Biology Committee charged us with exploring the possibility of expanding the sampling effort for larval Colorado pikeminnow in fiscal year 2003. One means of accomplishing this task was to include an additional sampling site in FY 2003 (increasing from two-to-three sites). Another suggestion for FY 2003 Colorado pikeminnow studies was to perform targeted sampling for pikeminnow similar to that being performed for larval razorback sucker. Collections targeting larval Colorado pikeminnow could be accomplished either by expanding the duration of the current larval razorback sucker survey (April-June) or through development of a discrete (new) project.

These and other items were considered and evaluated during the February 2002 San Juan River Biology Committee meeting. The team recommended the immediate by expansion of the larval razorback sucker survey (April-June) to encompass the months of June, July, and August with seining efforts to target sampling for Colorado pikeminnow. This change in sampling protocol required a deviation from the FY 2002 Scope of Work, was initiated July 2002 (using FY 2002 funds), and is proposed again for FY 2003.

Approval for this change in sampling was acquired at the 19-21 February 2002 San Juan River Biology Committee meeting in Farmington, New Mexico. The objectives of this specific monitoring effort are identified in the aforementioned document (1a, 3a, 3b) and listed below.

Study Area:

The principal sampling area for this study will be the San Juan River between Cudei Diversion Dam (near RM 142) and the Clay Hills boat landing (ca. RM 5) just above Lake Powell in Utah. This study will include acquiring collections in reaches of the San Juan River under the jurisdiction of the National Park Service.

Objectives:

1.) Determine the relative annual reproductive success of Colorado pikeminnow (1a)
2.) Provide annual summaries of monitoring results (3a)
3.) Provide detailed analysis of data collected to determine progress towards endangered species recovery in three years and thence every five years (3b).
4.) Provide comparative analysis of the reproductive success of San Juan River fishes
5.) Attempt to validate presumed spawning period of Colorado River pikeminnow

Methods:

Sampling for Colorado pikeminnow larvae will be conducted in the San Juan River between Cudei (RM 142) and Clay Hills (RM 2.9) from early July (ca. 1-10 July) through late-August (ca. 20-30 August). The tentative sampling schedule will be two trips per month. Access to the river and sampling localities will be acquired through the use an inflatable raft which will transport both personnel and collecting gear. There will not be a predetermined number of samples per

river mile or geomorphic reach for this study. Instead, an effort will be made to collect in as many suitable larval fish habitats as possible within the river reach being sampled.

As previous San Juan River investigations have clearly demonstrated that larval fish most frequently occur and are most abundant in low velocity habitats (i.e., isolated pools, backwaters, and secondary channels), sampling efforts will be concentrated in these mesohabitats. Small mesh seines (1 m x 1 m x 0.8 mm) will be the primary means of collecting larval fish from low-velocity habitats. Meso-habitat type, length, maximum depth, and substrate will be recorded for each sample. For seine samples, the length of each seine haul will be determined in addition to the number of seine hauls per site.

All retained specimens will be placed in plastic bags containing a solution of 5% buffered formalin and a tag inscribed with unique alpha-numeric code that will also recorded on the field data sheet. River Mile, standardized for the San Juan River Basin Recovery Implementation Program, will be the primary descriptor used to designate the location of sampling sites. Global Positioning System (GPS) readings (the principal numeric descriptor) will be taken at each sampling locality as stipulated at the May, 2001 meeting of the San Juan River Biological Committee. Universal Transverse Mercator (UTM) coordinates and zone will be determined with a Garmin Navigation Geographic Positioning System Instrument for each sampling locality and recorded on a field data sheet whose unique alpha-numeric code matches that of the tag in the retained sample.

Preserved collections will be returned to the laboratory where they will be sorted, specimens identified to species, enumerated, measured (minimum and maximum size [mm SL] for each species at each site), transferred to 70% ethyl alcohol, and catalogued in the Division of Fishes of the Museum of Southwestern Biology (MSB) at the University of New Mexico (UNM). Specimens whose species-specific identity is dubious or merit additional verification will be forwarded to Darrel E. Snyder (Larval Fish Laboratory, Colorado State University) for review.

Catch per unit effort (CPUE), for each seine sample, will be determined as the number of fish per m^2 of water sampled. The annual 2003 larval Colorado pikeminnow survey report will present, in summarized tabular form, fish catch rate (per species) for the entire study period as well by river reach. In addition, catch rate between and within reaches will be compared temporally. Detailed collection information (i.e., catch methodology, species composition of the sample, mesohabitat description, physical-chemical habitat characteristics, length and developmental stage of Colorado pikeminnow specimens) will be provided for samples that contain larval Colorado pikeminnow.

Community-comparison metrics, such as the Shannon-Wiener Index and Morisita's Index of Diversity, will be used for longitudinal and annual comparisons. Specimens will be distinguished and compared by residence status (native versus non-native) and catch rate over-laid with the annual hydrograph. Mean daily discharge data during the study period will be obtained from U.S. Geological Survey Gauges at Shiprock (# 09368000) of Four Corners (#09371010), New Mexico. These river discharge data will be used to assess the effect of discharge volume on species density estimates.

Products:

Draft reports for the 2003 larval Colorado pikeminnow sampling activities will be prepared and distributed by 31 March 2004 to the San Juan River Biology Committee for review. Upon receipt of written comments, that report will be finalization and disseminated to members of the San Juan River Biology Committee by 1 June 2004. Fish collected from those studies will be curated in the Division of Fishes, Museum of Southwestern Biology (MSB), Department of Biology, at the University of New Mexico. Original field notes will be retained in the Division of Fishes and collection information will be electronically stored in a permanent MSB database program where the geo-referenced collection information will be maintained in a consistent database and GIS format. These data and any maps generated from them will be available to the San Juan River Biology Committee via hard-copy reports and electronically. Electronic copies of the field and collection data will be transferred to the San Juan River database manager following the successful protocol previously employed.

Budget FY-2003:

Personnel	
Field Research Associate (55 staff-days) (sampling activities, collection management supervision, data entry, specimen identification)	$ 16,500
Field Research Technicians (64 staff-days) (sampling activities, collection processing)	$ 16,000
Subtotal	$ 32,500
Travel and per diem	
Travel (mileage – 4WD – Alb to sites)	$ 2,500
Field per diem (90 staff-days)	$ 4,500
Subtotal	$ 7,000
Equipment and Supplies	
Equipment repair and upkeep (trailer, drift nets, flow meters)	$ 1,500
Sampling/Field Gear (flow meters, t-posts, storage materials)	$ 1,500
Laboratory Equipment/supplies (fixatives,	$ 800
Subtotal	$ 3,800
Total	$ 43,300
Administrative Overhead	$ 6,500
GRAND TOTAL	**$ 49,800**

Out-year funding (based on 5% increases):

Fiscal Year 2001	**$ 35,834**
Fiscal Year 2002	**$ 40,940**
Fiscal Year 2003 *	**$ * 49,800**
Fiscal Year 2004	**$ 53,000**
Fiscal Year 2005	**$ 55,650**
Fiscal Year 2006	**$ 58,430**
Fiscal Year 2007	**$ 61,350**

Reflects a redistribution of a portion of the sample processing costs from the Specimen Curation project to the larval Colorado pikeminnow research project.

San Juan River Larval Razorback Sucker Survey
Fiscal Year 2003 Project Proposal

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Background:

In 1994, the first series of razorback sucker (n=672) were stocked in the San Juan River between Bluff, Utah and the Hogback, New Mexico. Mean length and mass of those individuals, at the time of stocking, was about 400 mm TL and 710 g, respectively. In 1995, 13 of the recaptured razorback sucker were tuberculate males and six of those individuals were ripe. Four recaptured 1995 razorback sucker were determined to be female but, unlike the males, none were sexually mature. In their 1995 report of activities, Ryden and Pfeifer (1996) suggested that the majority of the experimentally stocked San Juan River razorback sucker reached sexual maturity in 1995-96 and that spawning of these individuals might begin in the next two years.

The UNM-NMGF larval fish drift study, whose primary focus was determining spawning period, identifying approximate location of spawning sites, and assessing effects of annual hydrology (and temperature) on Colorado pikeminnow reproductive activities, provided similar information for other members of the ichthyofaunal community. At the November 1996 San Juan River Biology Committee integration meeting, it was suggested that a portion of the larval fish drift study be expanded to allow for documentation of razorback sucker spawning. However, because reproduction by razorback sucker (March-May) occurred considerably earlier than Colorado pikeminnow (June-July), separate investigations of spawning periodicity and magnitude were necessary for each species.

The most significant potential difference identified between the two studies, besides temporal differences in spawning, was that we were attempting to provide the first documentation of reproduction by individuals (razorback sucker) whose spawning potential had not been determined. Sampling for larval razorback sucker was being conducted with no assurance that the stocked population of adult razorback sucker would spawn in this system. Conversely, we knew from previous studies that Colorado pikeminnow reproduction had and was still occurring in the San Juan River and, because of this certainty, our larval fish sampling efforts for this minnow could be different than those for razorback sucker.

As numerous Upper Colorado River basin researchers had reported light-traps as one of the best means of collecting larval razorback sucker, we too elected to use that sampling procedure during the first year (calendar year 1997) of sampling. The only previous San Juan River fish investigation that employed light-traps was in 1994-1995 (conducted by the National Park Service) near the San Juan River-Lake Powell confluence. The 1994 sampling effort produced an extremely large number of larval fish (ca. 25,000) from a modest number of samples (n=20), of which over 99% were red shiner. Similar sampling in 1995 yielded 25,455 specimens in 47 light-traps samples and as in 1994, red shiner numerically dominated the catch. No Colorado pikeminnow or razorback sucker were taken in the 1994-1995 light-trap sampling efforts.

During the 1997 razorback sucker larval fish survey, light traps were set nightly in low-velocity habitats between Aneth and Mexican Hat from late March through mid-June 1997. The traps were distributed at dusk and retrieved about four hours later. Fish taken in those samples were preserved in the field. Sampling success during the 1997 razorback sucker larval fish study was quite poor. While there were over 200 light-trap sets, those sampling efforts produced only 297 fish. Of those, about 200 (66%) were larval suckers (either flannelmouth sucker or bluehead sucker). Larval razorback sucker were not present in the 1997 sampling survey. While there were probably several factors to account for the poor light trap catch rate, a principal factor was the limited access to suitable habitats. Light traps are most effective when set in habitats with little or no water velocity. During our driving survey of riverine habitats in the region (March 1997), we identified numerous locations that appeared to be suitable sites for light trap sampling. However, we found that high flow in the San Juan River eliminated virtually all previously identified low velocity habitats. Further driving reconnaissance failed to yield additional locations to set light traps. Being tied to specific collecting sites was not the most efficient means of collecting large numbers of individuals.

In 1998 we modified our sampling technique to allow for the sampling of a greater portion of the San Juan River and the collection of a significantly larger number of larval fish over a wider reach of the river. We conducted sampling forays (n=6) at approximately bi-weekly intervals from 17 April (first trip - no larval suckers) to 6 June 1998 between the Four Corners drift-net station (RM 128) and Bluff (RM 80) and used both active and passive sampling techniques to collect larval fish. The primary sampling method was a fine mesh larval seine (in 1998, we collected more larval sucker in a single seine sample than in all of the 1997 light trap samples). Passive sampling techniques were both drift-netting and the use of light-traps. Drift-nets were set periodically to determine if larval sucker comprised a significant portion of the drift community while light-traps were set adjacent to campsites if appropriate aquatic mesohabitats could be located. An inflatable raft was used to traverse this river reach and allow investigators the opportunity to sample habitats that were either not formerly accessible or observable under the constraints of the previous sampling protocol.

The 1998 sampling protocol resulted in 183 collections and 13,000 specimens between river miles 68.7 and 126.1. The majority of these individuals (n=9,960) were larval catostomids. This 43-fold increase in number of specimens, as compared with 1997, provided substantially better resolution of spawning periodicity of the sucker community. In addition, the 1998 samples produced enough individuals for investigators to determine, with a high degree of confidence, if razorback sucker reproduction occurred in the San Juan River during that period. None of the aforementioned information was obtainable from 1997 light-trap samples. In 1998, two larval razorback sucker were collected. These specimens provide verification of spawning by the re-established population.

In 1999, the study area was expanded to include the San Juan River from near Four Corners (River Mile 128) to near Clay Hills (River Mile 4.9). The scope of work for that year included at least one collecting effort between Sand Island and Clay Hills. A total of 174 fish collections were made in 1999 producing over 20,000 fishes. Over 37% of these individuals were sucker larvae (n=7,635). Seven larval razorback sucker were collected in 1999 between 4 May and 14 June. The seven larvae (razorback) were taken in backwater or low velocity habitats located between river miles 96.2 and 11.5. Almost half (n=3) of these individuals were in the new-downstream reach first sampled in 1999.

There was no substantive change in the sampling protocol or methodology for this project in 2000. A total of 210 collections were made between 4 April and 23 June 2000. These collections yielded 11,316 specimens of which 7,587 (67%) were larval sucker. There was a marked increase in the number of larval razorback sucker taken in 2000 as compared with 1999 and 1998. Identifications verified by Darrel E. Snyder (Colorado State University) revealed 138 larval razorback sucker in 24 separate collections. Individuals were collected in low velocity habitats between river miles 124.8 and 8.1. The lowest-most sampling location that yielded larval razorback sucker (RM 8.1) produced over 85 individuals in a single sample (26 May 2000). Conversely, the uppermost collection of larval razorback sucker was less than four river miles downstream of the upper boundary of the study area on 1 June 2000.

Likewise, there was no substantive change in the sampling protocol or methodology for this project in 2001. The 206 fish collections made between April and June 2001 yielded 96,590 specimens of which 42 were larval razorback sucker. Larval red shiner were much more prevalent in 2001 collections than during the previous year's sampling events comprising almost 88% (n=84,679) of the 2001 catch.

The results of this investigation suggest continued recruitment of adult reproductively mature razorback sucker to the population. The logarithmically increasing trend in the number of razorback sucker larval collected between 1998 and 2000 was not continued into 2001. That fewer larval razorback sucker were collected in 2001 should not be interpreted until collections from 2002 (and 2003) have been made, processed, and analyzed. Regardless of any change in larval razorback sucker catch rate between 2000 and 2001, the sampling process has proven an extremely effective means of monitoring this ontogenetic stage of this species.

This work is being conducted as required by the San Juan River Basin Recovery Implementation Program Monitoring Plan and Protocol dated 31 March 2000. The objectives of this specific monitoring effort are identified in the aforementioned document (1a, 3a, 3b).

Study Area:

Beginning in FY 2002 sampling was expanded (upstream) to include an additional 14 river miles of the San Juan River (the reach between Cudei Diversion Dam and RM 128). The principal sampling area for this study will remain the San Juan River between Cudei Diversion Dam (near RM 142) and the Clay Hills boat landing (ca. RM 5) just above Lake Powell in Utah. As in all post 1999 sampling efforts, the study will include making collections in reaches of the San Juan River under the jurisdiction of the National Park Service.

Objectives:

1.) Determine the spawning periodicity of razorback sucker between early-April and late-June and examine potential correlations with water temperature and river discharge.
2.) Attempt to validate presumed spawning period of razorback sucker using data from the razorback sucker and Colorado pikeminnow larval fish studies.
3.) Determine if reproduction by razorback sucker occurred in the San Juan River (upstream of Mexican Hat, UT)
4.) Provide comparative analysis of the reproductive effort of catostomids.
5.) Determine the relative annual reproductive success of razorback sucker (1a)

Methods:

Sampling for razorback sucker larvae will be conducted in the San Juan River between Cudei (RM 142) and Clay Hills (RM 2.9) from early April (ca. 1-10 April) through late-June (ca. 20-30 June). The tentative sampling schedule will be two trips per month. Access to the river and sampling localities will be acquired through the use an inflatable raft which will transport both personnel and collecting gear. There will not be a predetermined number of samples per river mile or geomorphic reach for this study. Instead, an effort will be made to collect in as many suitable larval fish habitats as possible within the river reach being sampled.

As previous San Juan River investigations have clearly demonstrated that larval fish most frequently occur and are most abundant in low velocity habitats (i.e., isolated pools, backwaters, and secondary channels), sampling efforts will be concentrated in these mesohabitats. Small mesh seines (1 m x 1 m x 0.8 mm) will be the primary means of collecting larval fish from low-velocity habitats. In addition, light-traps will be employed when appropriate aquatic low-velocity mesohabitats can be located adjacent to that evenings campsite. Meso-habitat type, length, maximum depth, and substrate will be recorded for each sample. For seine samples, the length of each seine haul will be determined in addition to the number of seine hauls per site. The aforementioned habitat conditions will also be recorded at light-trap sampling sites in addition to the time of placement, time of retrieval, and duration of the light-trap sample.

All retained specimens will be placed in plastic bags containing a solution of 5% buffered formalin and a tag inscribed with unique alpha-numeric code that will also recorded on the field data sheet. River Mile, standardized for the San Juan River Basin Recovery Implementation Program, will be the primary descriptor used to designate the location of sampling sites. Global Positioning System (GPS) readings (the principal numeric descriptor) will be taken at each sampling locality as stipulated at the May, 2001 meeting of the San Juan River Biological Committee. Universal Transverse Mercator (UTM) coordinates and zone will be determined with a Garmin Navigation Geographic Positioning System Instrument for each sampling locality and recorded on a field data sheet whose unique alpha-numeric code matches that of the tag in the retained sample.

Preserved collections will be returned to the laboratory where they will be sorted, specimens identified to species, enumerated, measured (minimum and maximum size [mm SL] for each species at each site), transferred to 70% ethyl alcohol, and catalogued in the Division of Fishes of the Museum of Southwestern Biology (MSB) at the University of New Mexico (UNM).

Specimens whose species-specific identity is dubious or merit additional verification will be forwarded to Darrel E. Snyder (Larval Fish Laboratory, Colorado State University) for review.

Catch per unit effort (CPUE), for each seine sample, will be determined as the number of fish per m^2 of water sampled. The number of fish collected per hour that light-traps are set will be presented as CPUE for this collecting methodology. The annual 2003 razorback sucker survey report will present, in summarized tabular form, fish catch rate (per species) for the entire study period as well by river reach. In addition, catch rate between and within reaches will be compared temporally. Detailed collection information (i.e., catch methodology, species composition of the sample, mesohabitat description, physical-chemical habitat characteristics, length and developmental stage of razorback sucker specimens) will be provided for samples that contain larval razorback sucker.

Community-comparison metrics, such as the Shannon-Wiener Index and Morisita's Index of Diversity, will be used for longitudinal and annual comparisons. Specimens will be distinguished and compared by residence status (native versus non-native) and catch rate over-laid with the annual hydrograph. Mean daily discharge data during the study period will be obtained from U.S. Geological Survey Gauges at Shiprock (# 09368000) of Four Corners (#09371010), New Mexico. These river discharge data will be used to assess the effect of discharge volume on species density estimates.

Products:

A draft report for the 2003 razorback sucker sampling activities will be prepared and distributed to the San Juan River Biology Committee for review by 31 March 2004. Upon receipt of written comments, that report will be finalized and disseminated to members of the San Juan River Biology Committee by 1 June 2004. Fish collected from this study will be curated in the Division of Fishes, Museum of Southwestern Biology (MSB), Department of Biology, at the University of New Mexico. Original field notes will be retained in the Division of Fishes and collection information will be electronically stored in a permanent MSB database program where the geo-referenced collection information will be maintained in a consistent database and GIS format. These data and any maps generated from them will be available to the San Juan River Biology Committee via hard-copy reports and electronically. Electronic copies of the field and collection data will be transferred to the San Juan River database manager.

Budget FY-2003:

Personnel		
Field Research Associate (65 staff-days) (sampling activities, collection management supervision, data entry, sample processing)	$	19,500
Field Research Technicians (48 staff-days) (sampling activities, collection processing)	$	12,500
Subtotal	$	32,000
Travel and per diem		
Travel (mileage, shuttle costs, vehicle storage)	$	2,500
Field per diem (33 staff-days)	$	1,500
Non-Field per diem (6 staff-days)	$	600
Subtotal	$	4,600
Equipment and Supplies		
Rafting Equipment maintenance/upkeep	$	2,000
Sampling/Field Gear	$	500
Laboratory Equipment/supplies (fixatives,	$	600
Subtotal	$	3,100
Total	$	39,700
Administrative Overhead	$	5,950
GRAND TOTAL	$	**45,650**

Out-year funding (based on 5% increases):

Fiscal Year 2001	**$**	**21,965**
Fiscal Year 2002	**$**	**38,525**
Fiscal Year 2003 *	**$**	***45,650**
Fiscal Year 2004	**$**	**50,330**
Fiscal Year 2005	**$**	**52,850**
Fiscal Year 2006	**$**	**55,500**
Fiscal Year 2007	**$**	**58,275**

Reflects a redistribution of a portion of the sample processing costs from the Specimen Curation project to the larval razorback sucker research project.

San Juan River Specimen Curation
Fiscal Year 2003 Project Proposal

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Background:

Personnel from the Division of Fishes, Museum of Southwestern Biology (MSB), at the University of New Mexico are responsible for two inter-related programs on the San Juan River. The Fish Division is the repository for specimens collected and retained by researchers. Fish taken under these programs are initially sorted by the principal investigator, held until they have submitted their yearly-progress report, and then received by MSB personnel. The collection is accessioned, specimens transferred from formalin to alcohol, identifications verified, individuals enumerated, length ranges recorded (largest and smallest specimen in a collection), collection data verified and transferred to wet labels, and incorporated into a database. It is standard policy at all major Natural History museums (i.e., Smithsonian Institution, Carnegie Museum, University of Michigan Museum of Zoology) that, prior to incorporation into the collection, all specimens be examined by qualified personnel (in that particular field of study) in an effort to verify the original identification and collection information. This system provides a final check (safeguard mechanism) to minimize the likelihood of misidentification of San Juan River fish species with particular attention on Colorado pikeminnow and razorback sucker. Any changes in species identifications that are detected are noted and returned to the principal investigator along with the entire data set (listing of collection locality, collectors, date, original field number, species, number of specimens, length ranges, and museum catalog number).

In addition to performing duties associated with collections curation, we are also responsible for complete processing (sorting, identifying, counting, curating, and reporting) of selected San Juan River collections (Colorado pikeminnow larval fish sampling and razorback sucker larval fish sampling). The samples generated by the aforementioned studies resulted in the collection of over 20,000 larval fish during 1999, 15,000 during 2000, and 96,000 during 2001. In 1999 and 2001, we processed almost 200,000 larval and juvenile fishes collected by the New Mexico Department of Game and Fish and Utah Division of Wildlife Resources. As in the past, deviations in the identifications of those samples have been noted and forwarded to the principal investigators. All of the non-MSB samples from calendar year 2001 have been received and are being processed by MSB personnel.

The number of fish processed by the MSB Division of Fishes under the San Juan River Recovery Program can fluctuate greatly between years. One reason for the vacillation in number of specimens is because the samples sent to MSB by non-MSB researchers are not processed until almost one year following their collection. This lag between time of

collection and MSB processing is necessary as individual researchers must perform the preliminary sort and require the specimens for preparation of their reports. Other factors such as annual variability of sampling conditions and initiation of new or completion of old projects has resulted in marked changes in the number of samples and specimens (As occurred between 2001 and 2002 when drift sampling for larval Colorado pikeminnow was eliminated in favor of seine sampling).

Discussion of this issue with the San Juan River Biology Committee resulted in the recommendation that the annual budget for the San Juan River Specimen Curation and Larval Fish Identification reflect an "average" year of sample processing. The Biology Committee recognized that some years would require more effort from MSB than budgeted while other years might not require the same high level of activity. A relatively stable budget allowed for uninterrupted processing of samples and was sufficient to allow the processing of backlogged samples generated during years of exceptionally high fish capture. To date, over 750,000 specimens (along with associated locality and ecological data) have been curated into the MSB Division of Fish Collection and are available to researchers

Almost all MSB-San Juan River Basin achieved samples are the result of collections made under the San Juan River Basin Recovery Implementation Program Monitoring Plan and Protocol. In addition, a component of New Mexico Department of Game and Fish collecting permits is the disposition of all retained specimens in the Museum of Southwestern Biology for curation.

Study Area:

This project does not involve the collection of specimens but instead the processing and curation of samples gathered by the different research components of the San Juan River Research program. The collective sampling area for other researchers will be the San Juan River between the outfall of Navajo Reservoir and the Clay Hills boat landing (RM 2.9) just above Lake Powell in Utah.

Objectives:

1.) Provide a permanent repository for San Juan River fish collections, field notes, and associated data
2.) Verify species identifications, enumerate specimens, and report to principal investigators
3.) Maintain a GIS reference database for current material
4.) Assist principal investigators with secondary collection sorting and identifications as time and resources permit

Methods:

The primary task to be completed under this project is the processing and curation of fish specimens generated by research projects executed under the auspices of the San Juan River Recovery Implementation Program. Samples are transferred to the Division of Fishes, by the principal investigator of a project, once that individual has completed their work and prepared the necessary reports. (This usually infers a lag-time of one year

between collection of specimens and transference to the Division of Fishes). Collections are matched with the appropriate data-sheet, transferred from formalin to alcohol, stored in museum quality jars, re-identified, counted, measured (range), labeled, and catalogued into the permanent MSB Fish Division collection and placed on the shelves in the light and temperature controlled collection room. All data associated with the specimens are entered into the database of the Division of Fishes and subsequently copied to the San Juan River database.

In addition to the aforementioned responsibilities, the Division of Fishes is available and has frequently assisted principal investigators by taking on the added responsibility of processing (a limited number) of their unsorted collections (without requesting additional funding). Specimens are sorted, identified, counted, measured, catalogued, and data submitted to the principal investigator for inclusion in reports. In cases where the amount of backlogged material in the possession of the principal investigator was beyond our capabilities, supplemental funds have been sought so that additional personnel can be hired (under the supervision of the permanent staff) to process the excess material.

Products:

A draft report of the 2003 San Juan River specimen curation and larval fish identification sampling activities will be prepared and distributed by 31 March 2004 to the San Juan River Biology Committee for review. Upon receipt of written comments, that report will be finalized and disseminated to members of the San Juan River Biology Committee by 1 June 2004. Fish collected from this study will be curated in the Division of Fishes, Museum of Southwestern Biology (MSB), Department of Biology, at the University of New Mexico. Original field notes will be retained in the Division of Fishes and collection information will be electronically stored in a permanent MSB database program. Electronic copies of the field and collection data will be transferred to the San Juan River database manager following the successful protocol previously employed.

Budget FY-2003:

Personnel		
Research Associate (36 staff-days) (final verification of all specimens, data compilation, data entry and management, supervision)	$	12,600
Subtotal	$	19,800
Travel and per diem		
Travel (airlines, mileage –2 trips)	$	700
Per diem (6 staff-days)	$	500
Subtotal	$	1,200
Equipment and Supplies		
Laboratory Equipment/supplies (vials, jars, alcohol, acid-free labels)	$	2,000
Computer supplies/maintenance	$	1,000
Subtotal	$	3,000
		24,00
GRAND TOTAL	**$**	**27,600**

Out-year funding (based on 5% increases):

Fiscal Year 2001	**$ 35,938**
Fiscal Year 2002	**$ 38,755**
Fiscal Year 2003 *	**$ * 27,600**
Fiscal Year 2004	**$ 28,980**
Fiscal Year 2005	**$ 30,429**
Fiscal Year 2006	**$ 31,950**
Fiscal Year 2007	**$ 33,550**

Reflects a redistribution of a portion of the sample processing costs to the larval Colorado pikeminnow and larval razorback sucker research projects.

Long Term Monitoring - Channel Morphology
Fiscal Year 2003 Project Proposal

Principal Investigator: Ron Bliesner
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Study Area:

The study area consists of the San Juan River and its flood plain from RM 180 (Farmington, NM) to RM 3 (Clay Hills Crossing).

Collections:

There are no collections associated with this study.

Background:

There are presently 25 river transects that have been established between RM 180 and RM 3 in the San Juan River for purposes of measuring channel scour and deposition. Additionally, substrate composition (sand or cobble/gravel) has been identified during each survey. These cross-sections have been surveyed before and after runoff since 1992. The data from these surveys was used to examine channel scour and deposition, determine change in channel capacity and track change in substrate material. Flow statistics for 8,000 cfs flows were based, in part, on these data.

Maintenance of cobble bars with open interstitial space has been determined to be important for spawning of Colorado Pikeminnow. Four of the sites (RM 173.7, 168.4, 132, 131) that have been identified in the San Juan River as having characteristics suitable for spawning have been monitored since 1995. The results of the surveys at this site were used as part of the basis of the flow recommendation at 8,000 cfs. To verify or adjust this recommendation, these sites will continue to be monitored.

The flow-habitat area model for backwaters is based on the ability of the channel to clean sediment from the system and the rate at which the sediment accumulates in the backwaters after runoff. The amount of perturbation (loss of habitat) due to summer and fall storms has been estimated based on analysis of habitat area data collected before and after storm events. Equivalent data on change in depth of backwaters and depth of sediment have not been analyzed. It is proposed that sediment depth and water depth be measured in backwaters twice yearly at the end of runoff in late July or early August and again in October to assess change. The second sampling will be completed during the fall habitat mapping exercise.

Objectives:

1.) River Geometry Monitoring. Determine short term and long term change in river cross sections at key locations and the relationship of this change to spring runoff and summer/fall storm events.

2.) Cobble Bar Monitoring. Determine short term and long term change in cobble bar characteristics in response to spring runoff and summer/fall storm events.

3.) Backwater Perturbation Monitoring. Monitor effect of spring runoff and summer/fall storm events on sediment accumulation in backwaters and backwater depth.

Methods:

1.) River Geometry Monitoring. The 14 cross-sections identified in 1999 as part of the long term monitoring plan will be surveyed pre- and post-runoff for analysis of annual change and compared to previous surveys to determine trends. Analysis of the change in cross-section geometry and substrate in relation to hydrographic conditions will be completed to monitor response of the system to flow recommendations.

2.) Suspended Sediment Analysis. Continuous turbidity monitors are installed at Shiprock, New Mexico and Montezuma Creek Bridge, Utah. The data will be used to qualitatively assess sediment transport in relation to the flow regime, in addition to identification of storm events.

3.) Cobble Bar Monitoring. Maintenance of cobble bars with open interstitial space has been determined to be important for spawning of Colorado Pikeminnow. Four sites (RM 173.7, 168.4, 132, 131) have been identified in the San Juan River as having characteristics suitable for spawning. These sites have been monitored since 1995. The results of the surveys at this site were used as part of the basis of the flow recommendation at 8,000 cfs. To verify or adjust this recommendation, these sites will continue to be monitored per the long range monitoring plan.

Topographic surveys will be completed for each of the sites utilizing total station or gps survey equipment with control provided by the established bench marks at each site. Surveys will be completed as soon as practical after spring runoff, usually during the end of July or early August. The same area will be surveyed each year to allow comparison to previous years.

At the same time, the structure of the bar will be assessed by completing point counts of the surface bed material (n=200 per sample or more) at each bar. Particles will be selected by the point count method over the full extent of the bar within the survey boundary. Size is determined by placing the rocks through a square hole in an aluminum plate, cut to represent an equivalent screen size from 1 cm through 10 cm at 1 cm increments, then 2 cm increments through 20 cm. Those larger than 20 cm are recorded as greater than 20 cm. Interstitial material smaller than 1 cm is not recorded.

Depth of open interstitial space (depth to embeddedness) will be measured on a 5 or 10-ft grid over the extend of the bar. Measurement will be made by working a hand between rocks until the fingers touch the sand embedded depth. The depth

of penetration below the average top of cobble immediately adjacent to the sample point will be measured and recorded as the depth of open interstitial space.

Change in bar morphology will be determined by producing three-dimensional plots of the surveyed surface and subtracting the resulting surface from the surface generated from the previous survey. The amount of change will be correlated to the flow conditions for the year.

The size distribution of cobble at each bar is computed and the D_{16}, D_{50} and D_{84} sizes reported and compared to previous years. Depth of open interstitial space will be computed as actual depth and multiples of mean cobble diameter.

4.) Backwater Perturbation Monitoring. To characterize the relative quality of backwaters, five representative backwaters within each geomorphic reach will be measured for water and sediment depth. Measurements will be made annually between September 15 and Nov 1 per the long term monitoring plan. These sites will remain the same from year-to-year to the extent possible. If a backwater is "lost," another will be selected for sampling and retained in the sampling regime until it is lost. Depth of sediment will be measured and recorded for "lost" backwaters. All measurements will be made at flows between 500 and 1,000 cfs, if possible, and at the same flow from year-to-year, if possible. Sediment and water depths will be measured at three points in each backwater (mouth, 1/3 and 2/3 of length). The backwaters sampled will be marked on digital aerial imagery.

Storm events will be determined by changes in flow and turbidity at USGS gages located near Shiprock and Montezuma Creek.

The annual report will include a summary of backwater measurement data for each site, including site location, water and sediment depth, flow at sampling, flow and turbidity data. Every five years the runoff/storm event/backwater habitat relationships will be analyzed.

Products:

An annual report and data files for inclusion in the GIS database will be produced under this task. The annual report will include a summary of backwater measurement data for

each site, including site location, water and sediment depth, flow at sampling, flow and turbidity data.

The draft progress report and data submittal to the database are due 31 March 2004. Final report is due 1 June 2004.

Budget FY-2003:

Category	Staff-Days	Cost
Personnel:		
Coordination & report	38	$ 25,680
Cross-section survey	37	$ 24,896
Spawning bar monitoring	34	$ 22,351
Backwater perturbation monitoring	29	$ 18,380
Subtotal	138	$ 91,307
Travel/per diem:		
Data analysis & report	0	$ 0
Cross-section survey	30	$ 2,960
Spawning bar monitoring	18	$ 3,860
Backwater perturbation monitoring	21	$ 4,275
Subtotal	69	$ 11,095
Equipment Rental (boats, survey inst.)		$ 1,430
Misc. supplies, copies,etc.		$ 2,013
Overhead (10% of subcontract)		$ 1,324
Grand Total		**$ 107,169**

This is a monitoring function and is expected to continue through 2007. Out year funding is expected to increase by approximately 5% annually due to inflation.

Habitat Mapping
Fiscal Year 2003 Project Proposal

Principal Investigator: Ron Bliesner
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(435) 753-5651 bliesner@kelbli.com

and

Principal Investigator: Vince Lamarra
Ecosystems Research Institute
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Study Area:

The study area consists of the San Juan River from RM 180 (Farmington, NM) to RM 3 (Clay Hills Crossing).

Collections:

There are no collections associated with this study.

Background:

Habitat mapping completed during the period 1992 - 1997 has been used to develop flow/habitat relationships used in the flow recommendation process. To verify and refine these relationships and examine long term trends, habitat mapping will be continued on an annual basis during the low flow period in the fall per the long range plan.

Objectives:

1.) Main River Habitat Mapping. Map San Juan River habitat from RM 180 to RM 0 during September-October. This objective is a continuation of the 2000 work as described in the long term monitoring program.

2.) Digitize and process data utilizing GIS. Habitat mapping data will be digitized and entered into the ArcCAD system.

Methods:

1.) Habitat mapping (San Juan River). One flight to collect digital aerial photography or videography will be completed for the San Juan River from RM 180 to RM 0 and printed at an approximate scale of 200 ft/inch. Thirty-eight categories of aquatic habitat will be mapped in the field utilizing the digital imagery as a base map. The flights and mapping will be completed as soon after runoff as flows reach 1,000 cfs or

less and weather will allow. Field mapping will be completed at flows between 500 and 1,000 cfs if possible.

Two of every three miles will be mapped through the full reach, corresponding with the miles designated for sampling under the other long term monitoring plans.

2.) Digitize and process data utilizing GIS. Upon completion of each habitat mapping program (Objectives 1 and 2), the field maps will be rectified and digitized into ArcCAD.

Products:

An annual report and GIS coverages for inclusion in the GIS database will be produced under this task. The annual report and coverages will be for the 2001 mapping. Reporting for the 2002 mapping will be in the 2003 budget. The draft progress report and data submittal to the database are due 31 March 2004. Final report is due 1 June 2004.

Budget FY-2003:

Category	Staff-Days		Cost
Personnel:			
Field Mapping & interpretation	58	$	29,064
Digitizing & data processing	46	$	23,560
Data Analysis	19	$	12,100
Subtotal	123	$	64,724
Travel/per diem:			
Field Mapping & interpretation	26	$	3,250
Digitizing & data processing	0	$	0
Subtotal	26	$	3,250
Equipment Rental (boats, equipment)		$	700
Videography flight (USBR)			9,000
Map prints, binders, misc. supplies		$	1,200
Overhead (10% of subcontract)		$	4,213
Grand Total		**$**	**83,087**

This is a monitoring function and is expected to continue through 2007. Out year funding is expected to increase by approximately 5% annually due to inflation.

Water Temperature Monitoring
Fiscal Year 2003 Project Proposal

Principal Investigator: Ron Bliesner
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78 East Center, Logan, UT 84321
(435) 753-5651 bliesner@kelbli.com

Study Area:

Temperature recorders are installed from RM 224 (Navajo Dam) to RM 92.5 (Montezuma Creek Bridge).

Collections:

None.

Background:

Water temperature recorders were installed in 1992. This work element is a continuation of the original work, with station servicing and data extraction.

Objective:

Collect Water Temperature Data at 7 locations

Methods:

Collect Water Temperature Data at 7 locations. Temperature recorders are located at Navajo Dam, Archuleta, Farmington, Shiprock, Four Corners and Montezuma Creek and on the Animas River at Farmington. These recorders will be serviced twice and the data extracted and plotted for the annual report.

Products:

An annual report and data files for inclusion in the GIS database will be produced under this task. The draft progress report and data submittal to the database are due 31 March 2004. Final report is due 1 June 2004.

Budget FY-2003:

Category	Staff-Days	Cost
Personnel:		
Data Collection	4	$ 2,580
Data Analysis	6	$ 4,340
Subtotal	10	$ 6,920
Travel/per diem:	2	$ 270
Data logging Equipment Rental		$ 200
Misc. supplies		$ 300
Overhead (10% of subcontract)		$ 0
Grand Total		**$ 7,690**

This is a monitoring function and is expected to continue through 2007. Out year funding is expected to increase by approximately 5% annually due to inflation.

Water Quality Monitoring
Fiscal Year 2003 Project Proposal

Principal Investigator: Ron Bliesner
Keller-Bliesner Engineering
78 East Center, Logan, UT 84321
(435) 753-5651 bliesner@kelbli.com

Study Area:

Water samples will be taken at 12 locations along the San Juan River or tributaries between RM 219 (Archuleta) and RM 52 (Mexican Hat).

Collections:

Water samples only

Background:

Monthly water samples during 1991-1998 have been collected at about 30 different sites in the San Juan River and its tributaries within the study area. The results of the water-quality analyses have shown that most concentrations are replicated between months and among nearby stations. The results of these analyses were used to identify the stations, set the timing and parameters of analysis.

Objective:

Collect Quarterly Water Samples at 12 Locations.

Methods:

Collect Quarterly Water Samples at 12 Locations. Depth integrated water samples will be collected at the 12 locations listed in Table 1. Samples will be taken quarterly in February, May, August and November of each year near mid-month. The chemical analyses most relevant to the long-term monitoring goals are listed in Table 2. The concentration of the parameters listed in the first column will be determined every sampling period. In addition field measurements of temperature, pH, redox potential, electrical conductivity and dissolved oxygen will be taken. Annually, during low flow periods in February, the water samples should analyzed for all the parameters listed in Table 2. Field data collection and laboratory analysis will be completed by standard EPA methods, where applicable.

Table 1. Proposed Sampling Stations along San Juan River between Navajo Dam and Mexican Hat.

Station Name	Station ID	USGS Sampling In Period	BIA Sampling Period
SAN JUAN RIVER NR ARCHULETA BRIDGE	9355500	1958-1984	1991-1998
GALLEGOS CANYON NR FARMINGTON, NM	9357255	1979-1981	1991-1998
ANIMAS RIVER AT FARMINGTON, NM	9364500	1958-1992	1991-1998
SAN JUAN RIVER AT FARMINGTON, NM	9365000	1974-1991	1991-1998
LA PLATA RIVER NR FARMINGTON, NM	9367500	1977-1991	1994-1998
OJO AMARILLO CANYON	9367536		1993-1998
SAN JUAN RIVER AT SHIPROCK, NM	9368000	1958-1992	1991-1998
MANCOS RIVER NR FOUR CORNERS	9371005		1991-1998
SAN JUAN RIVER AT FOUR CORNERS, CO	9371010	1977-1990	1991-1998
SAN JUAN RIVER AT MONTEZUMA CREEK BRIDGE	9378610		1991-1998
SAN JUAN RIVER AT BLUFF BRIDGE (HIGHWAY 191)	9379495		1991-1998
SAN JUAN RIVER NR BLUFF, UT (AT MEXICAN HAT)	9379500	1974-1993	1991-1998

Table 2. Water quality parameters for analysis

Quarterly	Annually
Arsenic (total and dissolved)	Aluminum (total and dissolved)
Calcium (dissolved)	Barium (total and dissolved)
Copper (total and dissolved)	Manganese (total and dissolved)
Lead (total and dissolved)	Nickel (total and dissolved)
Magnesium (dissolved)	Potassium (total and dissolved)
Mercury (total and dissolved)	Strontium (total and dissolved)
Sodium (dissolved)	
Selenium (total, dissolved, total recoverable)	
Zinc (total and dissolved)	Chloride (dissolved)
	Ammonia (dissolved)
Alkalinity(HCO_3)	Nitrate (dissolved)
Hardness	Nitrite (dissolved)
TDS	Silica (total and dissolved)
TSS	Sulfate (dissolved)
Turbidity	Orthophosphate (dissolved)

Products:

An annual report and data files for inclusion in the GIS database will be produced under this task. The draft progress report and data submittal to the database are due 31 March 2004. Final report is due 1 June 2004.

Budget FY-2003:

Category	Staff-Days	Cost
Personnel:		
Data collection and analysis	17	$ 4,887
Travel/per diem:	9	$ 1,000
Equipment cost (sampling equipment rental)		$ 900
Laboratory analysis		$ 19,000
Overhead (10% of subcontract)		$ 1,900
Grand Total		**$ 27,687**

This is a monitoring function and is expected to continue through 2007. Out year funding is expected to increase by approximately 5% annually due to inflation.

Polynuclear Aromatic Hydrocarbon (PAH) Study
Fiscal Year 2003 Project Proposal

Principal Investigator: Dale Wirth
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Background

In July of 1991, the Albuquerque District Office of the Bureau of Land Management (BLM) issued a Draft Resource Management Plan Amendment (RMP)/Environmental Impact Statement (EIS) regarding oil and gas leasing in San Juan, McKinley, Sandoval and Rio Arriba Counties. The main land mass affected by the RMP is under the management of the Farmington Field Office (FFO).

July 20, 1993, the United States Fish and Wildlife Service (USFWS) issued a Formal Section 7 Biological Opinion on the RMP/EIS. The Biological Opinion stated that "the ongoing and proposed oil and gas leasing and development activities are likely to jeopardize the continued existence of the Colorado pikeminnow (formerly Colorado squawfish) and the razorback sucker by reducing the likelihood of both the survival and recovery of the species through degradation of the aquatic habitat in the San Juan River".

In order to define parameters for the study identified in the Reasonable and Prudent Alternative, USFWS and BLM agreed to develop a project that would investigate possible sources of PAHs due to the federal oil and gas-leasing program. These sources include water and sediment from the San Juan, La Plata, and Animas Rivers, ephemeral washes, and discharge pits located on and directly associated with well locations. In addition, BLM and USFWS have agreed to work cooperatively to establish baseline air quality data that addresses possible impacts from the gas and oil production industry under the jurisdiction of the FFO.

The biological opinion that was published July 20, 1993 contained three phases for the PAH study to be conducted by the BLM. Phase I, conducted in 1994, established a baseline data set for the FFO for both streams and ephemeral washes, as well as, well locations in the vulnerable zone and in-stream semi-permeable membrane device placement to determine total cumulative exposures (performed by FWS).

Phase II of the study calls for any identifiable sources to be further investigated and remediated, and for continued monitoring throughout the basin, while Phase III calls for long term monitoring of PAHs throughout the FFO. In actuality, Phases II and III have been integrated and are considered as on-going processes

The major problem concerning the issue of PAH contribution by oil and gas development is the lack of surface water systems data within the Basin, PAH mobility data, a lack of information regarding toxicological effects, and possible PAH contributions form other likely sources within the Basin.

Due to the lack of data concerning the distribution of PAHs, one of the main goals of Phase I was to develop a database identifying the locations of possible sources and occurrences of PAHs. In order to achieve this goal, BLM developed maps of the sample collection locations, as well as an electronic database of all locations, sample types, and concentrations levels. This data is continually refined to include additional data, sample location data, newly collected analytical data, and other information that may be pertinent to evaluating the PAHs found.

The goals of Phase II and III focused on the locations that demonstrated measurable levels of PAHs and to try to determine if chemical migration was occurring from the locations. River monitoring was increased to both spring and fall to determine seasonal effects of high flows associated with spring run-off and low flows associated with the cessation of irrigation return flows in the fall.

BLM's data collection activities included surface run-off and oil and gas well locations located in the focused vulnerable area because of the concern that PAHs may be discharged to the surface water system via unlined pits associated with production activities. Types of waste discharges that are collected in pits in the basin include: condensate from pipeline drip, separator discharges, dehydrator drip, and brine water collection. The State of New Mexico Oil Conservation Commission initiated regulations for pit closures in 1988. Following the Oil Conservation Commissions pit closure regulations, the BLM implemented a pit remediation program designed to clean up potential groundwater contamination sources and replace the unlined pits with lined pits and/or tanks to prevent further releases on federal leases. BLM=s pit remediation program has been successful in the elimination of waste discharges into unlined pits located within and outside the focused vulnerable area.

Sampling of well locations included collecting a sample from within the pit, and another sample off-site and hydrologically down gradient. Samples were collected with an Oakfield stainless steel soil core sampler. The sampling depths varied depending on the accessibility to the pit, as well as sediment compaction. Generally, sample depths in the pits ranged from two to three feet while those collected down gradient were collected at a shallower depth of one to two feet.

Ephemeral streams were sampled throughout the basin in order to determine migration of PAHs via the ephemeral drainage system. Soil moisture was encountered from one inch to over two feet, depending on the size and location of he stream bed. Sample collection was done with an auger and core sampler similar to the well location samples. Depth for sample collection in the ephemeral streams ranged from six inches to two and one half feet.

Water and sediment samples were collected in twenty-five locations throughout the San Juan River Basin. Locations were chosen based on possible drainage and contaminant loading sources such as municipal discharges, industrial discharges, large ephemeral stream drainages and known agricultural return flow locations. In 1998, sample locations were expanded from twenty five to twenty seven locations. Water samples were collected in the water column by cross sectional and vertical stratification in two liter brown glass bottles at each location. Sediment samples were collected with a Weldco Hand Core Sediment Sampler to an average depth of two to six inches.

Air monitoring was conducted at ten deployment locations in the summer of 1998. Five locations were identified in upland areas and five were identified along river tracts. Each deployment site consisted of three semi-permeable membrane devices (SPMDs): site blank, exposure to direct sunlight, and canopy or shaded cover exposure for a total of 30 SPMD's. The locations selected were

developed in conjunction with the USFWS, and will provide information not only within the San Juan Basin, but will also provide information on PAHs that might be carried into the basin by prevailing winds. The air monitoring data will provide empirical data and will not provide data on air source locations.

The samples collected (air, water, and sediment) were analyzed by Quanterra Labs (now Severn Trent Laboratories, Inc, [STL]) in Denver, Colorado using EPA method 8310 for soil and water and EPA method 8270 for air. Detection limits in ug/kg and u/l were as follows:

PAH	Soils	Water
Napthalene	200	0.95
Acenapthylene	200	0.95
Acenapthene	200	0.95
Fluorene	40	0.19
Phenanthene	40	0.19
Anthracene	20	0.095
Fluoranthene	40	0.19
Pyrene	40	0.19
Benzo (a) anthracene	20	0.095
Chrysene	40	0.19
Benzo (b) fluoranthene	20	0.095
Benzo (k) fluoranthene	20	0.095
Benzo (a) pyrene	20	0.095
Dibenz (a,h) anthracene	40	0.19
Benzo (g,h,I) perylene	40	0.19
Indeno (1,2,0-cd) pyrene	40	0.19

Soil and water samples were collected and stored on ice in the field. The samples are transferred to a refrigerator at the FFO. All samples were shipped within 48 hours of collection. The samples were packed in cooler with ice and shipped to the Quanterra Lab overnight. Data reports were submitted directly to BLM along with an electronic copy.

Objective

Preliminary conclusions, based on the soil and water data collected over the past seven years in the San Juan Basin suggests that the oil and gas leasing program is not contributing PAHs to the

Colorado pikeminnow and razorback sucker habitat via surface run-off. Airborne contamination study results conducted in 1999 suggested that the biological effect of airborne PAHs on the aquatic ecosystem in the San Juan Basin is minimal.

The sediment and water sampling program has been relatively ineffective. Reasons for this may be attributed to the short life of PAHs, which are quickly partitioned either to sediment or biota, sediment cycling and removal, the complete absence of PAHs from the San Juan or Animas Rivers, or a combination of all these factors. Upon review of the water and sediment data, discussions and e-mail correspondences between the BLM and the USFWS Ecological Services Field Office, in Albuquerque, New Mexico were undertaken during June and July of 1999. A consensus was reached that additional monitoring of river water might not be as effective in determining major routes of PAH transport as would other methods, namely storm water collection and additional air monitoring.

Therefore, as a result of discussions and correspondence with the USFWS in 1999 the BLM will be continuing the Phase III long term monitoring for PAHs by collecting storm water runoff. Air monitoring obligations, as outlined in the Biological Opinion have been fulfilled and will not be undertaken for fiscal year (FY) 2002.

Method

Efforts will be made to obtain storm water samples for the identified drainages. However, discretion and flexibility will be exercised by BLM to substitute an alternate drainage in the immediate area in the event that identified drainage can not be sampled or fails to experience a storm water flow event. The five ephemeral tributaries include Canyon Largo, Gobernador Canyon, Shumway Canyon, contributing to the San Juan River and Ditch Canyon and Bohanon Canyon contributing to the Animas River. Water samples will be collected in two liter brown glass bottles at each location, stored on ice and shipped within 48 hours for analysis.

Products:

Preparation of a FY 2001 annual report will be forth coming. Preparation of an annual report and electronic data files for upcoming FY 2002 storm water sampling program is anticipated for the spring of 2003.

Budget FY-02:

Labor	$	10,000
Travel	$	2,000
Vehicle	$	1,000
Supplies	$	2,000
Overhead	$	5,000
Procurement	$	30,000
TOTAL	**$**	**50,000**

Update and Maintenance of San Juan River Recovery Implementation Program GIS Database and Development of a Web-based Interactive Interface
Fiscal Year 2003 Project Proposal

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Background

San Juan River research efforts that preceded the establishment of the San Juan River Recovery Implementation Program, in combination with those that have subsequently resulted from that program, form the basis of the suite of decisions already made and those to be made regarding biologic and hydrologic issues. An immense amount of information has been gathered through the San Juan River research activities that have been conducted over the last 15 years. Most of this information has been synthesized and made available in the form of reports or publications. For example, in 1999 and 2000 researchers consolidated and analyzed data from their individual long-term research projects and presented it as summary reports of seven years of research (1991-1998). Likewise, the flow recommendation report released in 1999 represented a synthesis between biological, hydrological, and habitat research activates.

Preparation of the aforementioned summary reports was facilitated by the existence of the San Juan River Recovery Implementation Program database. Individual researchers are responsible for submitting raw data for incorporation to the integrated database. This project was both initiated and maintained by Keller-Bliesner Engineering, LLC (Keller-Bliesner) in Logan, Utah in cooperation with the U.S. Fish and Wildlife Service's - Region 2 Albuquerque Office. Keller-Bliesner provided coordination of updates, maintenance, and distribution (via CD's) of the database.

There have been numerous important advances during the past five-years in GIS and database arenas that now allow for expansion of the electronic capabilities of the database and its associated information. Since many current San Juan River researchers do not have the expertise needed to use the GIS database in its present format, increase in the ease of use was identified as a principal need for future versions of the database. This modification is necessary to make the information available to more researchers within the program. Development of a user-friendly, web-based interface will decrease the time between distribution of updated versions of the database and enable researchers to access their own and other researchers' data in their analyses and reports.

Another important objective of this proposal is to provide for the generation of distribution maps that result from user-initiated queries. In 2000, an unfunded pilot project was undertaken (using exclusively San Juan River larval Colorado pikeminnow project data) whose goal was to provide a web-based interactive GIS query database (see: http://msb-fish.unm.edu/ArcIMS/Website/SJR_Test/index.htm). The results of this initial effort were well received, demonstrated the utility of such an effort, and fulfilled multiple project needs.

This proposal represents a shift in the objects of the database management project and will require several years to be fully realized. The purpose of this proposal is to seek funding to continue this effort with the goal of developing a (very) user-friendly web-based interface to San Juan River Recovery Implementation Program's GIS Database. In addition, continuation of funds to cover the cost of maintenance and distribution of the database are being requested.

The original proposal submitted to the San Juan River Biology Committee (SJRBC) anticipated a multi-step process to this work in which recent (2001-2002) data would have been used to develop a prototype database and interface (FY2003). The following year (FY 2004) would have been used to implement changes to the prototype that had been suggested by the SJRBC and incorporate upgrades, and process all geo-referenced data. The following two years (FY 2005 and FY 2006) would have involved the incorporation of all non-geo-referenced data. The transition phase from development to maintenance was to occur in FY 2007.

Upon review and request of the SJRBC, we have restructured the funding structure of the proposal so that between 75-90% of the work can be accomplished during year 1 (FY 2003). Year 2 (FY 2004) of the project will be devoted to making changes to the prototype and incorporation any remaining non-geo-referenced data. Year 3 (FY 2005) is now designed as transition period during which the project will no longer be in development but instead have as its primary tasks annual updates and regular maintenance.

Keller-Bliesner tasks and budget costs for facilitation of the transfer (year 1 of this project) are included in this proposal.

Study Area:

This project will initially encompass the San Juan River Basin downstream of Navajo Reservoir but should ultimately be expanded to include the entire San Juan River Basin.

Objectives (to be initiated in FY2003, with completion projected for out years):

- Develop a web-based interface to the San Juan River Recovery Implementation Program's GIS Database.
- Maintain, annually update, and distribute current San Juan River Recovery Implementation Program GIS researcher database using appropriate format.

- Establish electronic archives of the aforementioned database at the ultimate repository for this information (U.S. Fish and Wildlife Service Region 2 Office, Albuquerque, New Mexico).

Methods:

- Develop a web-based interface to the GIS Database.

  The San Juan River 2000 Larval Colorado pikeminnow Survey Data prototype web page (http://msb-fish.unm.edu/ArcIMS/Website/SJR_Test/index.htm) will serve as a foundation for the design of an interface which authorized researchers can use to access and analyze the data geographically. The interface will provide the ability to create custom multiple-parameter queries within the researchers' datasets and result in generation of maps and data reports that can be used in analysis as well as reporting activities.

- Update and Maintain GIS Database.

  Transfer the existing GIS Database, which has been maintained by Keller-Bliesner since its inception, to MSB/USFWS. Modify the database format (under consultation and coordination with Keller-Bliesner) if necessary to better integrate with the data program being prepared for GIS interface application. Assume responsibility for tracking (reminding) and acquisition of annual datasets to be submitted by 31 March of each year by individual researchers. Provide seamless incorporation of new data with the existing San Juan River Recovery Implementation Program's GIS Database.

- Coordinate Database Updates and Maintenance with FWS-Region 2. The close proximity of MSB to the U.S. Fish and Wildlife Service's - Region 2 Albuquerque Office provides for extensive coordination of updates, maintenance, and development of the database. The MSB staff will consult and coordinate closely with appropriate staff (including the San Juan River Program Coordinator and San Juan River Program Assistant) in the FWS-Region 2 office in all aspects of the work. This effort will result in the collaborative production of the database and web-based interface.

- Contact and coordinate with appropriate personnel in the Upper Colorado River Basin and Glen Canyon Environmental Studies offices to investigate the feasibility of linkage of the proposed San Juan River Recovery Implementation Database with other regional fish databases.

Products:

The database and associated documentation will be disseminated via a password-protected project web page. The database and interface will reside with Region 2 (Albuquerque) of the U.S. Fish and Wildlife Service, the designated repository for the data, and on a MSB server. A draft report that describes the results and progress of the FY

2003 efforts will be distributed by 31 March 2004. Upon receipt of written comments, that report will be finalized and disseminated to members of the San Juan River Biology Committee by 1 June 2004.

Budget FY-2003

Personnel	
Database Manager (80 staff-days) programming, data compilation, data management, supervision)	$ 40,000
Database Technician (80 staff-days) (data entry, data query)	$ 20,000
Programming Consultation (20 staff-days) (provide assistance with complex programming)	$ 10,000
Subtotal	$ 70,000
Travel and per diem	
Travel (mileage – attend two SJR meetings)	$ 500
Per diem (6 staff-days)	$ 500
Subtotal	$ 1,000
Equipment and Supplies	
Laboratory Equipment/supplies (CD's, office supplies)	$ 5,000
Computer supplies/maintenance (hardware and software upgrades)	$ 5,000
Subtotal	$ 10,000
Total	$ 81,000
Administrative Overhead	$ 12,150
TOTAL (UNM)	$ 93,150
TOTAL (Keller-Bliesner-detailed below**)**	$ 9,600
GRAND TOTAL	**$102,750**

Out-year funding (based on 5% increases):

Fiscal Year 2004 $ 48,000 Fiscal Year 2005 * $ * 39,280

The anticipated reduction in cost reflects completion of interactive database portion of the study and reflects a change in duties to that primarily of database management.

Objective (Keller-Bliesner):

Coordinate with UNM for the transfer of the database maintenance task to a web-based operation.

Methods (Keller-Bliesner):

1.) Prepare all data sets for transfer to UNM. All data sets now included in the database will be prepared for transfer to UNM, including metadata files and all products sent by individual contributors.

2.) Provide support in conversion to Web-based database. Support will be provided to UNM in understanding database construction, resolving problems and answering questions in the process of the transfer.

Products (Keller-Bliesner):

The production of the web-based database will be assisted by this activity. No actual deliverable is included.

Budget FY-2002(Keller-Bliesner):

Category	Staff-Days		Cost
Personnel:			
Prepare data sets for transfer	5	$	3,000
Support UNM in the transfer process	10	$	6,000
Subtotal	15	$	9,000
Travel/per diem:	0	$	0
Equipment Rental (boats, equipment)		$	0
CD's, copies, misc. supplies		$	500
Overhead (10% of subcontract)		$	100
Grand Total		**$**	**9,600**

There is no out-year funding for this task.

Summary of Monitoring Activities for 1999-2001

Principal Investigator: Paul Holden
Jicarilla Apache Nation
BIO-WEST, Inc.
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435-752-4202
pholden@bio-west.com

Background:

The San Juan River Monitoring Plan and Protocols calls for annual summaries of monitoring activities for all nine of the major monitoring activities (larval fish, small bodied fish, large bodied fish, channel morphology, cobble bars, backwater/low velocity habitat, habitat mapping, water temperature, and water quality). Reports vary in length from a few pages for activities such as temperature monitoring, to over 50 pages with many graphs for the adult fish monitoring. In addition, monitoring activities are being summarized for the first three years of monitoring (1999-2001), and in many cases will be compared with data collected during the 7-year research period (1991-1998). Hence, monitoring reports being prepared in 2002 may total 200 or more pages and include many individual analyses with graphs and accompanying tables.

During a Biological Subcommittee meeting held in Albuquerque on September 4 and 5, 2002, the subcommittee concluded that there was a need for someone to provide a summary of the individual monitoring reports so those not interested in wading through the entire stack of individual reports could still understand what was found in the first 3 years of monitoring. This scope of work proposes to develop a summary of the first three years of monitoring activities so the results can be more readily understood by Program participants and the general public.

Goal:

The goal of this scope of work is to prepare a summary for the 1999-2001 monitoring activities.

Methods:

Individual monitoring reports are due in late 2002 that will summarize the first three years of monitoring. Reports for physical studies may be later due to contracting problems. The reports will be reviewed and the most important information from each report will be used to develop a summary document. The document will concentrate on what was found for each monitoring activity and how they relate, based on the analyses in each monitoring report. In addition, flows from San Juan River gages will also be presented. No new analyses will be performed but an attempt will be made to provide the reader with a clear understanding of what was found and

what the various authors concluded from their studies based on a synthesis of all the reports and the goals of the monitoring activities as set forth in the Monitoring Plan.

A draft summary will be prepared 45 days following the completion of individual monitoring reports and provided to the Biology Committee and Hydrology Committee for review. Following a 15 day review period and a conference call, if necessary, final revisions will be made and the report will be finalized. The final report will include the summary, with the individual monitoring reports as appendices. An electronic copy will be provided to the Program Manager for distribution to the various SJRIP committees and interested publics.

Products:

A monitoring report that includes a summary plus individual monitoring reports.

Budget:

Personnel (250 man hrs.)	$14,000
Misc. supplies, copies, etc.	1,000
Total	**$15,000**

PEER REVIEW

Peer Review for 2003
Fiscal Year 2003 Project Proposal

Principal Investigator: Paul B. Holden
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Jicarilla-Apache Nation
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Background:

A Peer Review Panel was established in 1997 to assist the SJRIP with reports and plans for future studies.The four members of the panel participated in meetings in 1997 where the flow recommendations were discussed, and continued involvement in the flow recommendation report process by commenting on the pre-draft report and attending a Biology Committee meeting to discuss the pre-draft report in 1998. They also met with the Biology Committee in 1999 to discuss the draft flow recommendation report that the Biology Committee sent to the Coordination Committee for review. In addition, in 1999 the Peer Review Panel reviewed the draft Monitoring Plan, and initial drafts of the final research reports.

In 2000 and 2001, the Peer Review Panel reviewed and commented on the final research reports, the long term monitoring plan, and the Program Evaluation Report.

In 2002, the Peer Review Panel was changed somewhat. Drs. Ron Ryel and David Galat were retained from the existing panel and two new members were added. Dr. John Pitlick from the University of Colorado was selected as the geomorphologist and Dr. Stephen Ross from the University of Southern Mississippi was selected as the fishery ecologist after a lengthy selection process.

This proposal provides for funding for the Peer Review Panel activities during 2003. It is anticipated that the Panel will meet with the Biology Committee at two meetings during the year, the February, 2003 summary meeting and another meeting typically in May to discuss Scopes of Work for 2004.

Goal:

The goal of peer review is to provide additional scientific oversight over San Juan River Recovery Implementation Program technical studies and reporting. The Peer Review Panel will work with the Biology Committee to produce scientific credible documents and will assist the Biology Committee in maintaining a highly scientific direction to the Program.

Methods:

The Peer Review Panel will meet with the Biology Committee in 2003 two times to review monitoring and research progress and to discuss scopes of work for2004. They will provide verbal input during the meetings and provide written reviews of the progress of the Program. Their reviews will be provided to the Biology Committee through Dr. Paul Holden in letter form, and through

discussions at the Biology Committee meetings. Biology Committee researchers may call Peer Review Panel members to ask for advice, and Peer Review Panel members may call Biology Committee researchers if they have questions concerning Program activities. All correspondence between the Biology Committee and the Peer Review Panel will be coordinated through Dr. Paul Holden, who will maintain a record of these coordination activities for the Program.

Products:

Peer review participation at 2 Biology Committee meeting and additional subcommittee meetings, letter reports from each peer reviewer.

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Budget FY-03:

Payment for serving on the Peer Review Panel includes expenses for travel to and from meetings, and an hourly rate for services. It is anticipated that Panel Members will spend approximately 6 days each in 2003.

Salaries:	$	14,000
Travel:	$	8,000
Total	**$**	**22,000**

Future use of the Peer Review Panel is not known but they likely will be used each year to provide guidance to the Biology Committee.

Estimated Outyear Funding:

2004	**$22,000**
2005	**$25,000**
2006	**$25,000**
2007	**$50,000**

RESEARCH ACTIVITIES

San Juan River Population Model Maintenance
Population Model Runs
Fiscal Year 2003 Project Proposal

Principal Investigator: Bill Miller
Miller Ecological Consultants
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and

Principal Investigator: Vince Lamarra
Ecosystems Research Institute Research Institute
975 South State Highway, Logan, UT 84321
(435) 752-2580 vincel@ecosysres.com

Background:

A modeling effort to construct a conceptual framework for the fish community and endangered fishes in the San Juan River began in 1998. This effort relates to Sections 5.1; 5.1.1; 5.1.2; 5.1.3.; 5.1.4 of the Long Range Plan. These models have helped direct a focused field effort with the intent of using key site specific data to determine the carrying capacity of pike minnows and razorback suckers in the river. A mechanistic population model has been constructed from the original conceptual model.

The San Juan River population model includes bioenergetics, population, and trophic components. Data for fish populations by age class and habitats as well as other trophic components are required as model parameters. The intent of the FY2003 program is to refine the structural and functional components of the mechanistic model and make several model runs to evaluate stocking different size classes of Colorado pikeminnow and razorback sucker.

Objectives:

1.) Maintain Stella model software for the San Juan population model, which includes updating the model parameters with new information from the monitoring program.

2.) Make model runs to evaluate the stocking of different size classes of Colorado pikeminnow and razorback sucker on meeting recovery goal population levels.

Methods:

The model will be updated with current data on species distributions and abundance from population estimates and the standardized monitoring program. Model simulations will be made to evaluate the change in population dynamics as a result of stocking Colorado pikeminnow and razorback sucker. Model simulations will be conducted for Colorado pikeminnow stocked as young of the year and stocked as 150 mm size classes. A maximum of 10 different stocking rates for each species is proposed for model simulations.

Schedule:

Model maintenance will be concurrent with model simulations. Model maintenance will consist of updating the model with new model parameters based on new information and updating the model software as needed. Model maintenance will begin with the notice that funding has been secured. Completion of the model simulations and documentation of maintenance activities is scheduled for March 31, 2004.

Products:

A brief report will be prepared that documents the model maintenance and model runs. Summary tables of model simulations will be produced for each model run. A summary of model maintenance activities will be completed and submitted to the standardized data base.

Budget FY-2003:

All funding for FY 2003 activities are requested from the recovery program. Total funding requested is shown in the following table.

	Miller Ecological Consultants	Ecosystems/ Keller-Bliesner	Total Cost
Labor	$ 9,040.00 (15 Staff days)	$ 6,400.00 (10 Staff days)	$ 15,440.00
Travel	$ 735.00 (1 staff days)	$ 2,225.00 (4 Staff days)	$ 2,960.00
Equipment	$ 0.00	$ 0.00	$ 0.00
Supplies	$ 400.00	$ 550.00	$ 950.00
Overhead	$ 0.00	$ 918.00	$ 918.00
Total	$ 10,175.00	$ 10,093.00	**$ 20,268.00**

Characterization of Razorback Spawning Bar
Fiscal Year 2003 Project Proposal
(second year of 2-year study)

Principal Investigator: Ron Bliesner
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and

Principal Investigator: Vince Lamarra
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Study Area:

The study area consists of the San Juan River in the Vicinity of Aneth, UT, or other identified Razorback Spawning locations.

Collections: Interstitial and course substrate samples for grain size analysis.

Background:

Razorback sucker monitoring has identified aggregations of ripe males and females in a primary location in the river near Aneth, UT the last three years during typical spawning time. While actual spawning has not been observed, the conditions are right for spawning to occur and larval razorback suckers have been found in the larval drift studies downstream of this site. Since little is known about suitable spawning habitat for razorback sucker in the San Juan River, characterizing this site at or near the time of fish observation could aid in the understanding of the nature of the spawning site.

Objectives:

1.) Identify and characterize typical characteristics of a suspected razorback spawning site. (2002, verify 2003)

2.) Characterize habitat in the vicinity of the suspected spawning site. (2002, verify 2003)

3.) Identify other potential sites with similar characteristics (2003)

4.) Coordinate with the razorback sucker monitoring program to analyze findings.

Methods:

1.) Characterize spawning bar characteristics. As soon as the razorback sucker monitoring program identifies the presence of ripe fish at a location, a crew will be mobilized to the site to characterize the bar. (Up to three locations will be surveyed.) Topographic surveys will be completed for each of the sites identified utilizing total station or gps survey equipment and survey control bench marks established at each site.

At the same time, the structure of the bar will be assessed by completing point counts of the surface bed material (n=200 per sample or more) at each bar. Particles will be selected by the point count method over the full extent of the bar within the survey boundary. Size is determined by placing the rocks through a square hole in an aluminum plate, cut to represent an equivalent screen size from 1 cm through 10 cm at 1 cm increments, then 2 cm increments through 20 cm. Those larger than 20 cm are recorded as greater than 20 cm. Interstitial material smaller than 1 cm is not recorded.

Depth of open interstitial space (depth to embeddedness) will be measured on a 5 or 10-ft grid over the extend of the bar. Measurement will be made by working a hand between rocks until the fingers touch the sand embedded depth. The depth of penetration below the average top of cobble immediately adjacent to the sample point will be measured and recorded as the depth of open interstitial space.

Bar morphology will be determined by producing three-dimensional plots of the surveyed surface. Characteristics of the bar will be compared to other bars characterized during the 7-year research period.

The size distribution of cobble at each bar is computed and the D_{16}, D_{50} and D_{84} sizes reported and compared to previous years. Depth of open interstitial space will be computed as actual depth and multiples of mean cobble diameter.

Gross water quality parameters (temperature, DO, Ph, Conductivity) will be collected at the site and from local tributaries.

2.) Map habitat in the vicinity. Utilizing existing aerial photography taken near the flowrate at sampling as a base map, detailed habitat mapping will be completed to the long-term monitoring protocol for one mile up and downstream of the site. The information will be digitized and the data summarized.

3.) Identify other potential sites. Based on the characteristics identified at the suspected spawning sites, including vicinity habitat mapping, a review of mapped habitat will be completed and similar sites identified. A field investigation will be completed to characterize those identified as being similar utilizing the protocol in Task 1. This activity will be completed in the second year of the study based on preliminary data review in year one. The budget shown assumes complete surveys on 5 additional sites. If more sites are identified, the budget will be adjusted accordingly.

4.) Coordination with razorback sucker monitoring team. Data analysis will be coordinated with the razorback sucker monitoring team to compare habitat and substrate data with observed fish position. As disturbance of the fish at spawning time should be minimized, no field work will be completed without the approval of the Biology Committee and the razorback sucker monitoring team.

Products:

A summary report will be prepared covering the findings and comparing them to literature results, including unpublished observation data in the upper Colorado River Basin. A draft monitoring plan will also be prepared to track changes at this site and identify other potential sites. Draft report and data submitted to the database by March 31, 2004. Final report June 30, 2004.

Budget FY-2003:

Category	Staff-Days	Cost
Personnel:	73	$ 39,306
Field data collection, analysis, report		
Travel/per diem:	34	$ 4,350
Equipment Rental (boats, survey inst.)		$ 2,000
Misc. Supplies		$ 200
Overhead (10% of subcontract)		$ 2,066
Total		**$ 47,922**

Navajo And San Juan River Temperature Model
Fiscal Year 2002 Project Proposal

Principal Investigator: Amy Cutler
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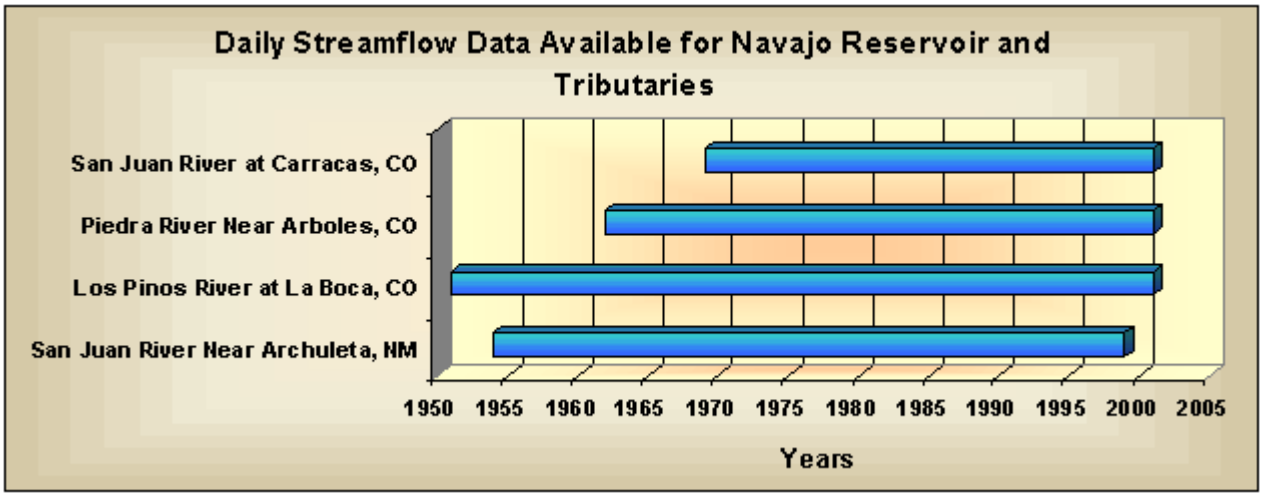
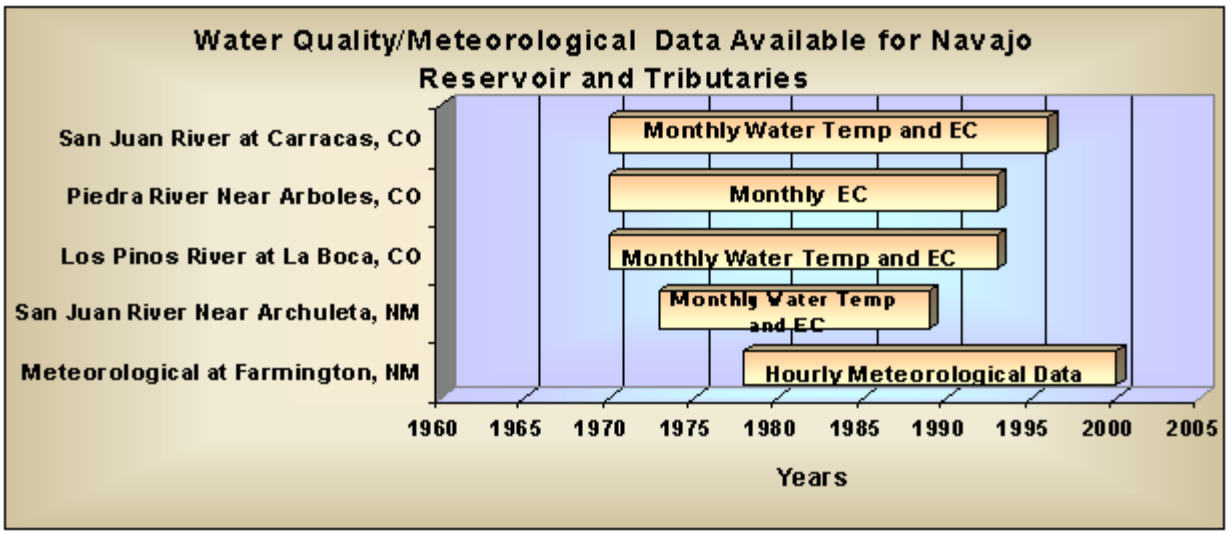
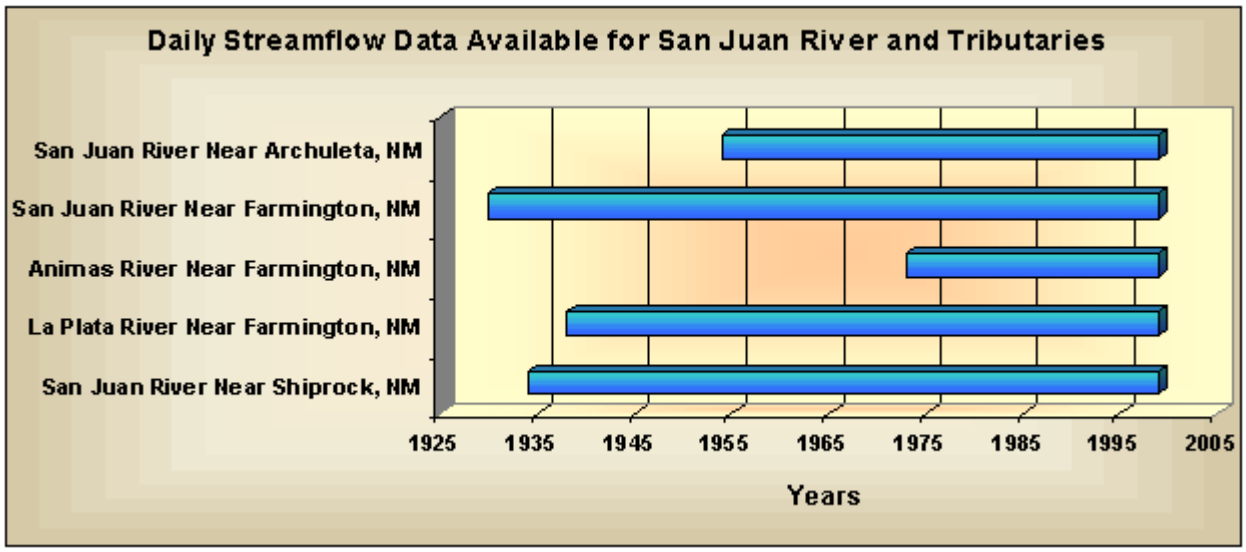
Background:

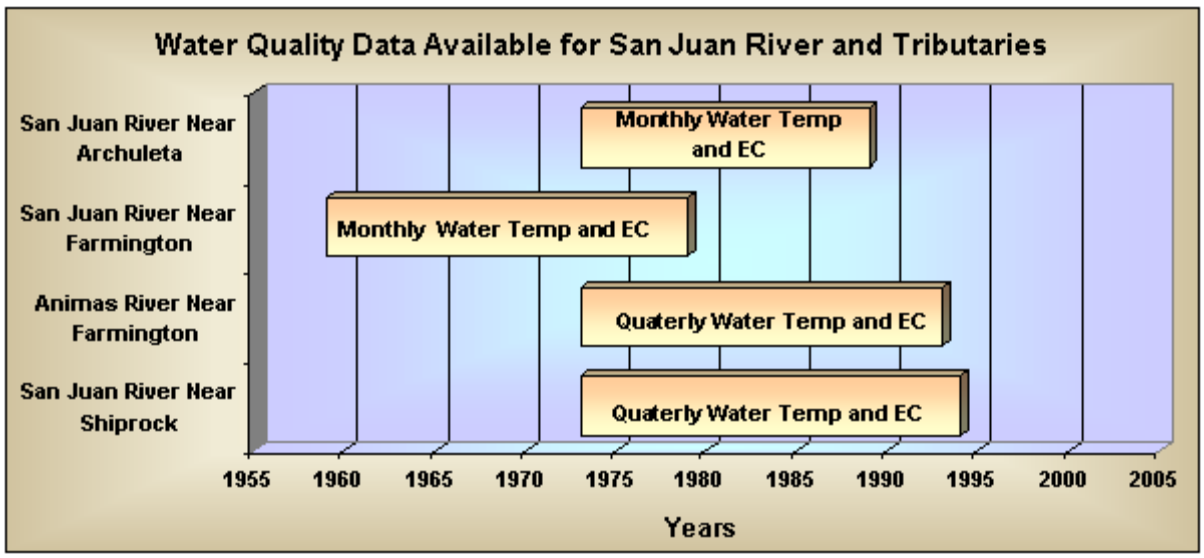
Studies have postulated that the changes in hydrology and water temperature releases from the Navajo Dam could benefit the Colorado pikeminnow and razorback sucker. It is believed that increasing temperatures in the San Juan River could benefit razorback sucker and Colorado pikeminnow growth and reproduction above River Mile 150 (near Shiprock NM). Specific temperature targets for the San Juan River are proposed to be developed in a separate scope of work for 2002. This scope of work proposes to use temperature models to determine the feasibility of achieving the desired river temperatures.

Presently there are streamflow, water quality and meteorological data available for the Navajo Reservoir and the San Juan River below the dam. The four graphs (below) indicate availability of data for certain periods from the USGS, Storet and National Weather Services Databases. Fundamentally the information available is sufficient to run temperature models. Based on the results of the models, more data could be gathered if fine-tuning is deemed necessary.




Water Quality/Meteorological Data Available for Navajo Reservoir and Tributaries
San Juan River at Carracas, CO
Piedra River Near Arboles, CO
Los Pinos River at La Boca, CO
San Juan River Near Archuleta, NM
Meteorological at Farmington, NM
Monthly Water Temp and EC
Monthly EC
Monthly Water Temp and EC
Monthly Water Temp and EC
Hourly Meteorological Data
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Years


Daily Streamflow Data Available for San Juan River and Tributaries
San Juan River Near Archuleta, NM
San Juan River Near Farmington, NM
Animas River Near Farmington, NM
La Plata River Near Farmington, NM
San Juan River Near Shiprock, NM
1925
1935
1945
1955
1965
1975
1985
1995
2005
Years



Objectives:

The objectives for this study are to find the best solutions to the followings:

1.) To determine potential temperature regimes in the San Juan River down to approximately River Mile 150 that would result from various TCD options.

2.) Compare and contrast release water temperature for a historic period with and without TCD modifications.

3.) Determine the times of year in which water temperature targets can be met.

4.) Determine the effect of TCD on the heat budgets in the reservoir.

The above goals will be addressed through the utilization of reservoir and river temperature models applied to the Navajo Reservoir and the San Juan River using CE-QUAL-W2 (W2) and QUAL2E. These models will predict release temperatures with different TCD scenarios, and river temperature variations with changes in flow.

Study Area:

The study area includes Navajo Reservoir and the San Juan River below Navajo Dam to Shiprock.

Methods:

A two phased approach will be used to determine potential temperature regimes in the San Juan River below Navajo Dam to Shiprock. The W2 model will be used to determine available temperatures for various reservoir release options and to model the initial tailwater reach as mixing occurs if various penstock/TCD release options are utilized. The Qual2E model will use the output generated by the W2 model and flow information to determine downstream warming in the river to Shiprock. Phase one will define the best time period to incorporate the model of the Navajo Reservoir using W2. The W2 model requires meteorological data including hourly air temperatures, dew-point temperatures, wind speeds, wind directions and cloud covers, as well as data indicating daily inflows and outflows of all major tributaries, inflow and outflow water temperatures, total dissolved solids (TDS) and total suspended solids (TSS). Finally, detail geometry of the reservoir and the downstream tailwater must be obtained. A combination of topographical map and the "Instream Flow Incremental Methodology" study will be used to generate reservoir and river geometries for the Navajo system. The models will be calibrated using in-reservoir temperature profiles and release time-series water temperature data. The calibrated water temperature model will be used to test combinations of flows and withdraw levels in the reservoir to meet the target temperature range for the downstream needs of the San Juan River. Similar work has been done on the Glen Canyon Dam where a temperature control device (TCD) is being considered to help endangered fishes. We applied W2 on Lake Powell. We were able to determine the earliest date when the temperature target can be met, whether the heat budget in the reservoir is affected, and the most effective TCD design. Phase two will incorporate reservoir release water temperatures modeled by W2 as inputs to the river model (QUAL2E).

Schedule:

1.) Analyze data to select best period for modeling (May 2002).

2.) Build detail geometry data for Navajo Reservoir and downstream tailwater (July 2002).

3.) Input model data (September 2002).

4.) Calibrate reservoir temperature models (January 2003).

5.) Analyze temperature scenarios (March 2003).

6.) San Juan River temperature model using QUAL2E (May 2003).

7.) Report (September 2003).

Deliverables/Due Dates:

1.) Data analysis: May 2002
2.) Detail Geometry of reservoir: July 2002
3.) Input model data: September 2002

Budget FY-2002:

Labor	$ 21,720.00
Travel	$ 1,240.00
TOTAL	**$ 22,960.00**

FY - 2003:

Deliverables/Due Dates:

1.) Reservoir model calibrations: January 2003
2.) Scenario analyses: March 2003
3.) River model: May 2003
4.) Final report: September 2003

Budget FY-2003:

Labor	$ 22,400.00
Travel	$ 1,240.00
TOTAL	**$ 23,640.00**

Budget Summary (FY 2002 - 2003):

FY-2002	$ 22,960.00
FY-2003	$ 23,640.00
TOTAL	**$ 46,600.00**

References:

Cole, T. M. 1995. "A Two-Dimensional, Laterally Averaged, Hydrodynamic and Water Quality Model, Version 2.0", Final Report E-86-5, U.S. Army Corps of Engineers.

Holden, B. P. (Ed.). 1999. "Flow Recommendations for San Juan River", San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, NM.

Temperature Modeling for Navajo Reservoir and San

	Temperature Modeling for FY-2002		
Budget Category	**Unit (day)**	**Unit Cost**	**Total Cost**
Personnel			
WQ scientist (UCRO)	5	$504.00	$2,520.00
Engineer (UCRO)	30	$360.00	$10,800.00
Technician (UCRO)	10	$280.00	$2,800.00
Grad Student (BYU)	20	$280.00	$5,600.00
Total Personnel Costs			$21,720.00
Travel	**Unit (person)**	**Unit Cost**	**Total Cost**
Airfare	4	$200.00	$800.00
Per diem	4	$110.00	$440.00
Total Travel Cost			$1,240.00
Total Cost for FY-2002			**$22,960.00**

	Temperature Modeling for FY-2003		
Budget Category	**Unit (day)**	**Unit Cost**	**Total Cost**
Personnel			
*Model Review	10	$800.00	$8,000.00
Engineer (UCRO)	40	$360.00	$14,400.00
Total Personnel Costs			$22,400.00
Travel	**Unit (person)**	**Unit Cost**	**Total Cost**
Airfare	4	$200.00	$800.00
Per diem	4	$110.00	$440.00
Total Travel Cost			$1,240.00
Total Cost for FY-2003			**$23,640.00**

Total Project Cost	**$46,600.00**

*Model Review: The models will be reviewed by J. E. Edinger Associates, Inc.

Research and Applications in Watershed and Waterbody Science Consultants

Assessment of Fish Movement
Through the Non-Selective Fish Ladder
at Hogback Diversion, New Mexico

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Background:

Instream diversion structures on the San Juan River between Farmington, New Mexico and near Shiprock, New Mexico have been the subject of previous evaluations regarding effects on movement of fishes (Masslich and Holden 1996, Ryden 2000). These diversion structures can effect fish communities by impeding fish movement, entrainment and through disturbance in both benthic and fish communities during routine repair and reconstruction periods. Field measurements of movement patterns for tagged fishes in reaches 5 and 6 by Ryden (2000) indicated that fish could move upstream of diversion structures at Cudei (142.0), Hogback (RM 158.6), APS (RM 163.3), PNM (RM 166.6), and Fruitland (RM 178.5). Upstream movements were detected for common carp *Cyprinus carpio*, bluehead *Catostomus discobolus* and flannelmouth *Catostomus latipinnis* suckers, and channel catfish *Ictaluras punctatus*.

In 2001, Cudei was removed and replaced by a sub-surface syphon which has no visible impediment to fish movement. This structure may now make an additional 16.6 RM (Hogback Diversion at 158.6 to Cudei at 142.0) readily accessible to both native and non-native fish movement. Hogback was rebuilt, including construction of a non-selective fish passage structure. Although this structure has made an additional eight river miles accessible to native fishes including the endangered Colorado pikeminnow, *Ptychocheilus lucius*, and razorback sucker, *Xyrauchen texanus*, its construction does not limit movement solely to native fishes.

During 2001, mechanical removal efforts targeting channel catfish in a sub-portion of Reach 6 (PNM downstream to Hogback) continued and a total of ten sampling efforts removed 4,024 individuals. Declining trends in abundance and distribution of channel catfish removed (n = 1340) were observed over eight sampling trips prior to spring runoff. In the four remaining sampling efforts (July, August, September, November) the number of channel catfish removed doubled (n = 2,689). Possible explanations for the increased catch of channel catfish included warmer water temperatures and associated activity level of fish during late summer/autumn and low, clear flow conditions during the last four sampling efforts. An additional explanation may be the completion of the non-selective fish passage structure at Hogback and resulting upstream movement of channel catfish during spring runoff and throughout summer.

A study to assess fish passage utilization through the Redlands Diversion structure on the Gunnison River, Colorado from 1996-2000 indicated heavy use of the fish ladder with over 43,000 individuals passing during the study period (Burdick 2001). This structure is a selective fish passage with all native fishes collected transferred above the diversion and all non-natives

removed. Data indicated that the majority of channel catfish utilized the fish ladder from June-August of each year.

In order to adequately evaluate the efficacy of mechanical removal in decreasing distribution and abundance of large bodied non-native fishes in discreet river reaches, a better understanding of diversion structures that include non-selective fish passage structures and the role they play in fish movement is needed. Mechanical removal of large channel catfish (>500 mm) and subsequent availability of habitat may encourage movement from downstream reaches to occupy these now vacant territories. In addition, the upstream movement of striped bass *Morone saxatilis* from Lake Powell and documented occurrence within Reach 6 downstream of PNM Weir could increase and further impact the native fish community.

Prior to completion of Hogback reconstruction, the diversion structure likely limited upstream movement of fishes and the new fish ladder has lessened that impediment. As a response to this concern, the last mechanical removal effort during 2001 (early November) and the last during pre-spring runoff in 2002 (early April) included one additional sampling day each to capture, implant with numbered dangler (FLOY) tags, and release channel catfish the first 5.5 river miles downstream of Hogback Diversion. Plans for remaining mechanical removal efforts in 2002 include additional tagging of channel catfish downstream of Hogback Diversion for determination of movements upstream.

This scope of work proposes to evaluate the upstream movment of the four most common large-bodied fishes in the San Juan River (common carp, bluehead and flannelmouth suckers, channel catfish) past Hogback Diversion. While other diversion structures modified for fish passage in the Upper Colorado River Basin have been evaluated for movement (Tom Nesler, CDOW, pers. comm.), the structurally different and non-selective fish ladder at Hogback has not and the ability to allow upstream movement should be verified. Similar to studies by Ryden (2000), fishes will be tagged using numbered and distinctly colored dangler tags and released from below Hogback Diversion. Tagging and monitoring efforts will be combined with and added to existing non-native mechanical removal efforts. In addition, monitoring and evaluation of movement upstream of APS Weir will be characterized if fish tagged below Hogback Diversion move upstream through both diversion structures.

Study Area:

The study area for assessing use of the non-selective fish ladder at Hogback Diversion is from PNM Weir (RM 166.6) downstream to approximately 5.5 river miles downstream of Hogback Diversion (RM 153.0).

Objectives:

1.) Determine utilization of the non-selective fish ladder at Hogback Diversion by common carp, bluehead and flannelmouth suckers, and channel catfish.

2.) Relate non-selective fish passage results to attainment of non-nativeremoval target objectives.

3.) Relate results towards future recommendations regarding fish ladder design at other diversion structures on the San Juan River.

Methods:

A minimum of four (4) sampling trips will be conducted and all common carp, bluehead and flannelmouth suckers, and channel catfish will be tagged in the study area prior to spring high flow conditions. Effort will be focused prior to high spring flow conditions to maximize possible recaptures during peak movement seasons that were observed by Burdick (2000). Fish will be collected using a raft-mounted electrofishing unit. During these sampling efforts, all non-native fishes collected will be measured for total and standard lengths (nearest 1mm), weighed (nearest 5g) and equipped below the dorsal fin with a visual dangler tag. Dangler tags will be blue in color and will have a unique numeric code preceded by the initials SJR. These tags will be identical to those used in previous channel catfish tagging studies (Brooks et al. 2000) Data taken will be separated by river mile and reach and effort (minutes electrofishing) will be recorded to calculate catch per unit effort (number fish per minute electrofishing). Rare fish collected will be identified, measured for total and standard lengths, weighed, checked for the presence of a PIT or radio tag, appropriate fish tagged, and immediately released. Specific river mile of capture and comments on relative condition of the fish will also be recorded.

Tagging and monitoring movement of tagged fish will be accomplished in conjunction with non-native mechanical removal trips performed by the U.S.F.W.S., New Mexico Fishery Resources Office and cooperators (U.S.F.W.S - Grand Junction, U.S. Bureau of Indian Affairs, State of New Mexico, State of Utah). Fish recaptured above the diversion will be measured for total and standard lengths, weighed and tag number recorded. Location of recapture, to the nearest 0.1 RM will be recorded and all non-native fish will be sacrificed. Additional monitoring of tagged fish movement will occur during the autumn main channel standardized monitoring trip.

During all sampling efforts, temperature (Celsius), dissolved oxygen (mg/l), salinity (ppt), turbidity (uohms), and secchi disk depth (nearest 0.1 m) will be recorded and related to fish sampling results. In addition, stream discharge as reported by USGS gauging station #09365000 (2.3 miles upstream of the La Plata confluence) will be recorded to evaluate discharge influences on fish movement through the Hogback fish ladder.

Deliverables:

A summary report detailing findings will be completed in draft by 31 March 2004 for SJRIP Biology Committee review and finalized by 1 June 2004. An electronic data file will be provided for inclusion in the centralized database by 31 March 2004.

Budget:

Personnel:	
Collection and tagging (20 man days)	$ 5,000
Monitoring (10 man days)	$ 2,500
Reporting/data management (40 man days)	$ 10,000
Subtotal	$ 17,500
Travel/per diem:	
Collection/tagging	$ 1,500
Reporting/data management	$ 200
Subtotal	$ 1,700
Equipment and supplies	
Collection/tagging	$ 1,000
Miscellaneous	$ 500
Subtoal	$ 1,500
T0TAL	$ 20,700
Administrative Overhead (20%)	$ 4,140
GRAND TOTAL	**$ 24,840**

Outyear Funding (an increase of 5% included):

Fiscal Year 2004	$ 26,082

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Brooks, J.E., M. J. Buntjer, and J.R. Smith. 2000. Non-native species interactions: management implications to aid in recoveery of the Colorado pikeminnow and razorback sucker in the San Juan River. San Juan River Basin Recovery Implementation Program, USFWS, Albuquerque,New Mexico

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Masslich, W. and P.B. Holden. 1996. Expanding distribution of Colorado squawfish in the San Juan River. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, NM.

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TROPHIC RELATIONSHIPS AMONG COLORADO PIKEMINNOW (*PTYCHOCHEILUS LUCIUS*) AND ITS PREY IN THE SAN JUAN RIVER

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BACKGROUND

An essential element of restoration or recovery of an endangered species, such as Colorado pikeminnow (*Ptychocheilus lucius*), is a thorough understanding of the relative importance of factors that have contributed to its decline. Various studies (e.g., Holden and Wick 1992, U.S. Fish and Wildlife Service 1990, Platania et al. 1991) have demonstrated that altered flow regimes, habitat modifications, range fragmentation, and establishment of numerous nonnative fish species have contributed to the imperiled status of Colorado pikeminnow. To enhance survival of the species, efforts have been made to remove or ameliorate factors identified as causing its decline. In addition, augmentation of extant populations by stocking hatchery-reared fish has been undertaken in the San Juan River. All efforts to improve the status of Colorado pikeminnow by increasing its abundance implicitly assume there is an adequate prey base. However, considering the dramatic changes to the prey assemblages in this system, there is no clear evidence that adequate prey is available.

In the San Juan River, the historical prey base of Colorado pikeminnow was composed mainly of soft-rayed cyprinids and catostomids; other fishes such as mottled sculpin (*Cottus bairdi*) and cutthroat trout *(Oncorhynchus clarki*) occurred mainly in habitats upstream of those occupied by Colorado pikeminnow. Based upon their current distribution throughout warmwater reaches of the San Juan River and their high abundance (Gido et al. 1997, Gido and Propst 1999, Propst and Hobbes 2000), speckled dace (*Rhinichthys osculus*), flannelmouth sucker (*Catostomus latipinnis*), and bluehead sucker (*Catostomus discobolus*) were likely important prey for Colorado pikeminnow. Although currently rare in the San Juan River, roundtail chub (*Gila robusta*) and razorback sucker (*Xyrauchen texanus*) were more common historically (Tyus et al. 1982) and thus potential prey of Colorado pikeminnow. In the past 100 years, over 20 nonnative fishes have become established in the San Juan River; some are common and generally distributed, but others are rare (Bestgen 2000). Common and widespread nonnative fishes include red shiner (*Cyprinella lutrensis*), common carp (*Cyprinus carpio*), fathead minnow (*Pimephales promelas*), and channel catfish (*Ictalurus punctatus*). Although other ictalurids (e.g., *Ameiuus* spp.), in addition to channel catfish, and centrarchids are established in the San Juan River, none are common (Propst and Hobbes 2000, Ryden 2000).

Colorado pikeminnow begin to consume fish at an early age and small size (Vanicek and Kramer 1969). As an individual increases in size, its potential prey likewise increases in size. To some extent prey availability is mediated by the habitat occupied by different life stages, of Colorado pikeminnow. Young (<1 yr) and small (<100 mm TL) individuals that primarily inhabit low-velocity habitats, such as backwaters, prey largely upon syntopic species such as larvae or young of large-bodied species (e.g., roundtail chub and flannelmouth sucker). As Colorado pikeminnow grow, and move from low-velocity into main channel habitats, the size range and variety of prey likely increase, typical of piscivorous fishes (Gerking 1994). At this point, an individual's gape dimensions and where it forages are major factors limiting prey size and variety. In primary channel habitats typically occupied by adult Colorado pikeminnow, its primary prey species historically were speckled dace and sub-adults and adults of roundtail chub, flannelmouth sucker, bluehead sucker, and razorback sucker. Although speckled dace, flannelmouth sucker, and bluehead sucker are currently common in the San Juan River, historical data are insufficient to determine whether abundance of any, or all, have declined, increased, or remained constant. Roundtail chub and razorback sucker, however, are now less common than historically (Tyus et al. 1982, Platania et al. 1991).

Three factors probably were major determinants of prey consumed by Colorado pikeminnow: habitat occupied, gape dimensions, and prey encountered. To the extent that habitat of a potential prey species differs from that typically occupied by Colorado pikeminnow, the less likely it is to be preyed upon. For example, individuals that occupy off-primary channel habitats (e.g., small, shallow secondary channels) are likely less susceptible to predation by adult Colorado pikeminnow than those in primary channel habitats. For sub-adult Colorado pikeminnow, however, shallow secondary channel habitats may be accessible and thus provide forage. Small-bodied fishes, while more abundant than large-bodied individuals, are presumably more energetically costly than larger prey species because of the large number necessary to maintain basal metabolic demands. Moreover, prey items of Colorado pikeminnow may be dependent on its hunting tactics. If it is largely an ambush predator, habitat occupied largely determined what it would most likely to encounter and therefore consume. Alternatively, if it stalks or actively hunts prey and moves among habitats, diversity of prey likely increased.

Introduction and establishment of nonnative fish species, both caused the decline of native fish species (via competitive interactions or predation by nonnatives) and the addition of potential prey items for native predators. Whereas these nonnative fishes may serve as prey for Colorado pikeminnow, they may be better adapted to escape predation than native prey species because they evolved in eastern systems with higher densities of predators. Thus, it is unclear what effect the establishment of nonnative species and decline of native prey species had or will have on populations of Colorado pikeminnow. Has the introduction of nonnative species increased, decreased, or had no effect on the forage base? Or, as assemblage structure and composition changed, has Colorado pikeminnow foraging success declined, increased, or remained the same? A key question is whether changes in prey base affected viability of Colorado pikeminnow in the San Juan River and if these changes are likely to impair success of augmentation efforts.

We propose a series of field experiments, using recently developed stable isotope tracer technology, to evaluate relative use of native and nonnative prey species by Colorado pikeminnow. This study will quantify the dietary importance of commonly occurring species (e.g., native flannelmouth sucker, bluehead sucker, and speckled dace and nonnative common carp, red shiner, fathead minnow, and channel catfish) under controlled and existing "natural" conditions. In addition, roundtail chub will be used in experiments to determine if Colorado pikeminnow preferably forage on this species, which was once abundant in the San Juan River. Finally, our results will complement existing bioenergetics models (Lamarra and Miller) by quantifying relative importance and caloric content of different tropic levels.

Recent developments in mass spectrometry have enabled the use of naturally occurring stable isotopes of nitrogen (^{15}N) and carbon (^{13}C) to determine trophic position and trace pathways to determine ultimate energy sources. Ratios of $^{15}N/^{14}N$ are typically low in naturally occurring elements. Stable isotopes of nitrogen (^{15}N) are particularly helpful in evaluating trophic position of organisms because individuals that feed high in the food web (i.e., predators) tend to be enriched with heavy ^{15}N, which accumulates during protein synthesis at a faster rate than the lighter ^{14}N isotope. Stable isotopes also provide information on the source(s) of energy. For example, Cherel et al. (2000) were able to establish the breeding origins of seabirds by analyzing stable isotope signatures in feathers. McCarthy and Waldron (2000) were able to differentiate freshwater-resident and sea-run migratory brown trout based on changes in stable isotopes of N and C in their tissues. Martinez et al. (2001) characterized the isotope ratios of fishes in the Colorado River basin and suggested that isotopes may be helpful in determining if off-channel ponds were the source of nonnative fishes. Thus, naturally occurring stable isotope ratios can be used to determine the origin of energy assimilated by organisms, which compliments traditional food habits studies that only give a snap-shot of food items consumed at a particular moment. In addition, components of natural systems can be enriched with ^{15}N and then those molecules can be followed through the system to quantify energy transfer (e.g., Dodds et al. 2000). We propose to use this technology combined with a series of field experiments to evaluate the relative contribution of potential prey, including roundtail chub, to Colorado pikeminnow in the San Juan River.

Below, we describe a series of field and laboratory studies and experiments to examine the relative importance of common native and nonnative fishes in the diet of Colorado pikeminnow. The first phase of the proposed study will be to identify caloric content and signatures of stable isotopes of N and C at all trophic levels in the San Juan River (organic sediments through "top" predator) in each geomorphic reach of the river (Farmington to Lake Powell). The next phase of the study will quantify differences in prey behavior among native and nonnative species and vulnerability of these species to consumption by Colorado pikeminnow using a combination of artificial streams and field experiments. We also will use ^{15}N tracers during these experiments to positively identify native prey species of Colorado pikeminnow.

The overarching goal of this study is to assess the capability of current San Juan River prey base for maintenance of viable Colorado pikeminnow populations. Specific objectives/goals of the study are:

1) Characterize prey base of Colorado pikeminnow and linkages with lower tropic levels by determining stable isotope signatures (^{15}N and ^{13}C) of the biotic assemblages in the San Juan River for six geomorphic reaches of the river (Farmington to Lake Powell).

2) Work in conjunction with Lamarra and Miller to incorporate prey suitability, trophic relationships, and caloric content of lower trophic groups into bioenergetics models. Quantify caloric content for different trophic levels in the San Juan River by reach to parameterize bioenergetics models for Colorado pikeminnow.

3) Determine if Colorado pikeminnow use nonnative prey as efficiently as native prey by conducting foraging experiments in artificial streams located at the Konza Prairie Biological Station (KPBS), Kansas and in field enclosures in secondary channels of the San Juan River.

4) Quantify the use of specific prey items by Colorado pikeminnow by using ^{15}N labeled roundtail chub and other fish species in field enclosure experiments.

STUDY DESIGN

Stable isotope signatures and caloric content—To establish baseline data on carbon and nitrogen isotope signatures of the fish assemblage in the San Juan River, we will collect and analyze samples from fishes and potential prey items from the six geomorphic reaches of the San Juan River from Farmington to Lake Powell beginning in 2003. In addition, we will analyze these samples for caloric content. Both the stable isotope analysis and the caloric data will help quantify the feeding relationship and energy requirements of Colorado pikeminnow and its prey. This aspect of the study will complement the bioenergetics modeling of Lamara and Miller and thus, we will work to coordinate our sampling and analysis to accommodate those models. Collections of fish tissue will be made in conjunction with ongoing monitoring programs to facilitate capture of fishes. Small-bodied fishes will be collected whole, whereas tissue plugs or fin clips will be taken from large-bodied native and nonnative fishes. This information will allow us to characterize trophic position of each species in the assemblage and possibly determine specific prey items of native (Colorado pikeminnow) and nonnative (channel catfish) predators. These data also will provide essential information on naturally occurring levels of these isotopes to compare with the experiments described below.

Tissue samples from fishes and other organisms from lower trophic levels will be frozen in the field and brought to the laboratory, thawed, dried at 50oC for 48hr and ground to a powder with a mortar and pestle. Ground samples will be analyzed in the Stable Isotope Mass Spectrometry Laboratory (SIMSL) in the Division of Biology at Kansas State University (KSU) using a ThermoFinnigan Delta Plus mass spectrometer. Stable isotope ratios will be calculated in the standard notation:

$$\delta^{15}N = [{}^{15}N/{}^{14}N_{sample}/{}^{15}N/{}^{14}N_{standard}) - 1 \times 1000$$
$$\delta^{13}C = [{}^{13}C/{}^{12}C_{sample}/{}^{13}C/{}^{12}C_{standard}) - 1 \times 1000$$

Values will be expressed on a per mil (‰) basis. Because carbonates are known to bias isotope ratios of carbon, a separate aliquot will be taken from each sample, acidified to remove carbonates and then analyzed for carbon isotope ratios as described above. A pilot study, in which samples from the San Juan River community were taken in October 2001 demonstrated our ability to process samples necessary to complete the proposed experiments using the facilities at KSU. Although we did not collect samples from adult native fishes, preliminary results suggest a high degree of overlap in energy acquisition between juvenile natives and adult nonnative fishes (Figure 1). In addition, spatial variation in δ13C signatures between backwaters (Green algae and chironomids) and main-channel habitats suggest a high potential to determine the relative importance of different habitats for consumer species.

Caloric content of fish, invertebrate, and plant material will allow us to evaluate the potential quality of different resource bases for Colorado pikeminnow. Measurements will be made with a Parr semi-microbomb calorimeter. For fishes, only muscle tissue from the dorsal region will be used. All samples will be homogenized as described above and pressed into a pellet for combustion in the calorimeter.

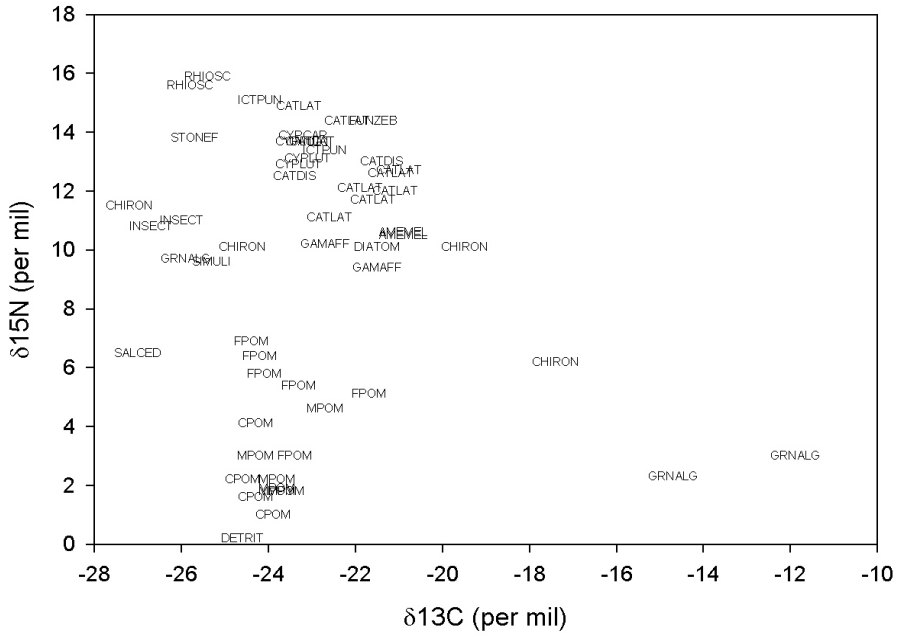

Figure 1. Stable isotope signatures for various components of the aquatic community in the San Juan River between RM 120 and RM 90. Abbreviations are as follows: Labels for fishes include the first three letters for the genus plus the first three letters of the specific epithet; FPOM, MPOM, and CPOM = fine, medium, and coarse particulate organic matter, respectively; CHIRON = chironomid; STONEFL = Stoneflies; GRNALG = green algae; SIMULI = Simulids; DETRIT = Detritus; SALCED = Salt Cedar; INSECT = various insects.

Artificial stream experiments

A combination of artificial streams and field enclosures will be used to quantify the importance of native and nonnative fishes as prey by Colorado pikeminnow. Artificial streams are located at the KPBS in Kansas and have been designed to match the stream units that have been successfully used in previous experiments at the University of Oklahoma (Gido et al. 1999, Gido and Matthews 2001, Matthews et al. 2001). Each stream will be configured to have two pools connected by a riffle (Figure 2) and mimic natural pool and riffle habitats. These systems should provide sufficient structural heterogeneity to provide cover for experimental fishes. Substrate will be a mixture of cobble, gravel, sand, and silt to match conditions in the San Juan River (i.e., predominately sand and cobble substrate). This experiment will examine changes in behavior of the various prey fishes in the presence of a caged Colorado pikeminnow. In addition, we will release the pikeminnow and determine its foraging efficiency on the different prey species. Our working hypothesis is that nonnative species will alter their behavior more than native species in the presence of Colorado pikeminnow and thus be less vulnerable to predation than the native species.

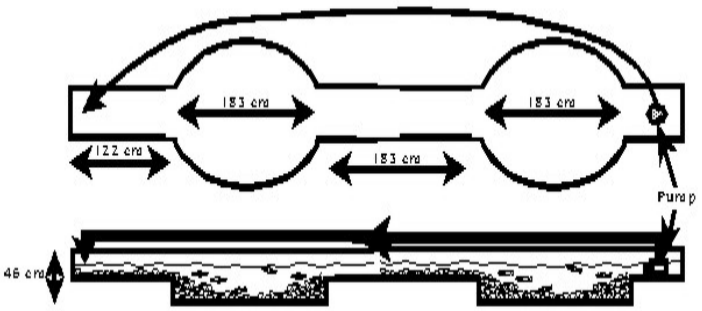

Figure 2. Configuration of artificial stream to be used to test prey response to and foraging efficiency of Colorado pikeminnow.

Prey behavior trials –In this experiment we will monitor the behavior of three native species (speckled dace, flannelmouth sucker, and roundtail chub) and two nonnative species (red shiner and fathead minnow) before and after the introduction of a caged pikeminnow into the streams. Five replicate trials will be run for each species using different fishes. The prey fish will be stocked at moderate densities (sensu Gido and Propst 1999) in the streams, 24 hr before the introduction of the pikeminnow, to allow them time to "adjust" to the system. After this period, habitat use of each individual will be characterized. Next, one caged pikeminnow will be placed into a randomly selected pool. Habitat use of the prey species will be measured one hour after the introduction of the pikeminnow. Habitat use measurements will include location in the water column (surface, bottom, etc.), mesohabitat (pool or riffle), proximity to caged predator, and activity rates (e.g., feeding, swimming, resting).

Predation efficiency - Additional experiments will be conducted to determine the relative predation efficiency of pikeminnow on the various prey species. Stream configuration, stocking densities, and acclimation period will be the same as above. However, in these trials, the pikeminnow will be released and allowed to forage on the various prey species. The pikeminnow will be removed after 24 hours and all fish will be removed from the streams to determine the number consumed by the pikeminnow. Pikeminnow will be starved for 48 hr prior to the foraging efficiency experiment.

For all experiments, the fishes will be kept at a holding facility at Kansas State University and facilities will be modified to preclude accidental escape of San Juan fishes in the Kansas River system. For this experiment and those described below, all the appropriate permits necessary to work with endangered species and the transfer of nonindigenous fishes will be obtained beforehand.

Field experiment

Results from the experimental stream studies will be complimented with field enclosure experiments to evaluate our ability to scale our results up to natural systems. Field enclosures will allow us to recapture Colorado pikeminnow, prey species, and nonnative predators at the end of the experiment. For these experiments, 10 mm-mesh plastic netting will be used to block six ca.100-m reaches in a secondary channel of the San Juan River. Previous studies (e.g., Gido et al. 1997, Gido and Propst 1999) found that 100m reaches of San Juan River secondary channels contained a diverse array of habitats including pools, riffles, eddies and backwaters. Thus, these reaches should adequately represent major habitats available to pikeminnow and their prey. Reaches will be selected to have similar physical habitat features (e.g., depth, flow and large woody debris). Each reach will be sufficiently long (100 m) so that fishes behave normally and predation rates by Colorado pikeminnow will not be artificially high. After block nets (constructed of wire mesh and secured to the substrate with rebar) are in place, each reach will be sampled with three or more passes of a seine and DC-pulsed backpack electrofisher to quantify species present in the experimental reaches. All captured fish will be identified, counted, and released back into the reach from which they were captured. Muscle plugs will be taken from 30 to 50 individuals of each species for isotope characterization. If there are major differences in assemblage structure among enclosed reaches, we will remove or add fish to facilitate comparisons among reaches. After fish are sampled, three of the six reaches will be stocked with 5 sub-adult pikeminnow (200 to 350 mm TL). Prior to stocking, these individuals will be marked with a PIT tag and a tissue plug will be taken for isotope analysis. By monitoring changes in abundance of all species relative to enclosures without Colorado pikeminnow, we will be able to quantify changes in mortality rates of nonnative prey species as well. Captive-reared and nitrogen –labeled roundtail chub will be placed in one exclosure during each trial.

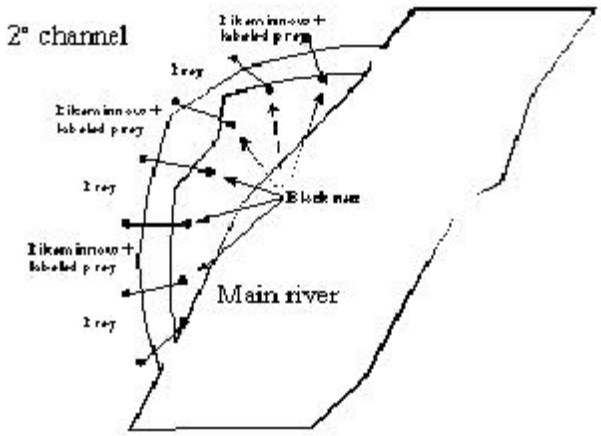

Figure 3. Design of field enclosure experiments to be conducted in San Juan River secondary channels.

We will attempt to run the experiment twice a year for two years to account for temporal variation in abiotic and biotic conditions. The length of each experimental run will be approximately two weeks, assuming this will be adequate time to uptake sufficient ^{15}N for detection, as determined from laboratory experiments (see below). A field crew consisting of at least two individuals will be on site during each experiment to monitor field conditions and clean debris and maintain block nets. At the end of the experiment, a combination of seining and DC-pulsed backpack electrofishing will be used to capture all stocked fishes from each reach. A sample of dorsal muscle tissue will be taken from each pikeminnow, frozen and returned to the laboratory for analysis. Channel catfish and any other predators captured during this study will be sacrificed for tissue samples and analysis of stomach contents. All other fishes captured will be identified, measured, and released, with the exception of labeled prey species, which will be preserved in 10% formalin and returned to the laboratory to characterize growth during the experiment.

During Year 1 of this study, we will construct block nets on one secondary channel to evaluate the feasibility of the field experiments. These trials will deploy block nets in various configurations

to determine the most efficient and trouble-free configuration. We will also conduct depletion sampling within block nets to evaluate sampling efficiencies. A subsample of captured fishes will be marked (fin clip) during initial sampling efforts. Recapture (or not) of marked fish will allow evaluation of recapture probability during field experiments. If we are able to maintain block nets and contain fishes for two weeks, we will proceed with the experiments the following year.

Field trials will be conducted from cessation of spring runoff (late June-early July) through early autumn (late September) during summer 2004 and 2005. The two field experiments will be conducted within a six week period; the second experiment will occur two weeks after completion of first experiment. Information and insights gained during the first run will be considered in making changes to the experimental design in subsequent trials.

Probability of success will depend on the frequency of flood events that may destroy or damage exclosures. An evaluation of historic flows from the USGS gauging station at the Four Corners Bridge indicates we have a very high likelihood of success. We selected a likely starting date of 1 July and examined previous discharge records between 1978 and 2000 to determine how many years there would have been a significant flow event during a two week period after 1 July. In three of the 23 years examined, the flow in the river doubled in the two weeks following 1 July, suggesting a 13% chance that our experiment would be ruined. However, if we attempt these experiments during two years, or twice each year, the chances of a flood of sufficient magnitude to destroy or damage exclosures drops to 1.7 % or less. Moreover, we will closely monitor weather forecasts to increase our chances of success.

Laboratory study to evaluate use of $\delta^{15}N$ as a tracer

In conjunction with the artificial stream and field experiments, we will evaluate the feasibility of using ^{15}N labeled prey items to confirm consumption of particular prey species by a predator. This will allow us to separate losses of prey items to natural mortality from those consumed by pikeminnow. Brine shrimp cultures will be reared at KSU and their tissue will be ^{15}N enriched by feeding them algae grown in ^{15}N labeled ammonium chloride. The ^{15}N labeled shrimp will be stockpiled in a freezer and used to enrich the tissues of captive native San Juan fishes (roundtail chub, speckled dace, and flannelmouth sucker). To evaluate the uptake efficiency and tissue enrichment of the ^{15}N in the prey, tissue samples from five individuals of each species will be taken one, two, and three weeks after the initiation of a ^{15}N enriched brine shrimp diet and analyzed for ^{15}N using procedures described above. To further evaluate the ability of the ^{15}N label in minnows and suckers to be transferred to a predator, we will feed the ^{15}N enriched fish to pikeminnow at a rate of one individual per day for one, two, and three week periods and measure ^{15}N accumulation in pikeminnow muscle tissue from five individuals after different feeding durations. We will use the results from this study to adjust the amount of time necessary to feed prey fishes a ^{15}N labeled diet and the number of ^{15}N labeled prey fishes that are necessary for the pikeminnow to consume to detect their consumption in the field. In addition, this will allow us to assess our ability to use ^{15}N concentration in pikeminnow tissue to quantify the biomass of prey consumed. That is, individuals that consume a greater quantity of enriched prey should have higher concentrations of ^{15}N in their tissue.

Data analysis

Differences in isotope signatures among geomorphic reaches will first be assessed using biplots of $\delta^{15}N$ and $\delta^{13}C$ signatures. Significant differences among reaches for each species will be assessed using Analysis of Variance (ANOVA) with post hoc corrections for multiple comparisons. ANOVA also will be used to evaluate difference in prey behavior and prey mortality rates in the presence or absence of Colorado pikeminnow in artificial stream and field experiments. Because the field experiments will be repeated over time (i.e., two years), year of experiment will be included as a blocking variable. Finally, paired t-tests will be used to evaluate differences in $\delta^{15}N$

in Colorado pikeminnow tissue before and after field experiments stocked with enriched native fishes. This will allow us to confirm the consumption of different prey species under natural conditions.

Significance of Proposed Research

Recovery of endangered species often depends on maintaining important linkages of imperiled species with other components of the ecosystem. Hydrology and fish assemblage structure has been drastically altered in the San Juan River. Thus, recovery efforts to increase populations of Colorado pikeminnow may depend on restoring both a natural hydrology and other native species populations, such as roundtail chub. The proposed research will quantify the use of both native and nonnative prey species in the diet of Colorado pikeminnow. In addition, we will generate energy density information that can be used to refine bioenergetics models that estimate carrying capacity of the system. This information will strongly influence management decisions to either supplement native prey species or eradicate nonnative species. Moreover, by examining the consumption of prey items by nonnative predators (e.g., channel catfish), we can evaluate the potential competitive interactions among these fishes. This proposed study, if conducted, will provide information necessary to achieve SJRRIP Long Range Plan Objectives 4.4, 5.3.6, and 5.4.3. The use of manipulative field experiments will build upon existing correlative data (e.g., monitoring programs and carrying-capacity modeling efforts) to characterize the interactions of Colorado pikeminnow with native and nonnative fishes in the San Juan River, and to provide information that enables implementation of adaptive management strategies to recover Colorado pikeminnow in the San Juan River.

SCHEDULE

The first year of the proposed research will focus on collecting tissue samples for isotope signatures and caloric content. This information will help define the trophic interaction of Colorado pikeminnow and its prey resources. In addition, we will conduct several pilot experiments to assess the feasibility of the proposed field experiments. Thus, at the end of the first year, we will evaluate the likelihood that forthcoming experiments will be successful. If it is determined, based on pilot projects, that the experiments have a low probability of success we will either modify the proposed activities accordingly, or terminate the experiments and spend a second year finalizing a written report of the first year's results.

Timeline
June 2003 – May 2004: Collect samples from six geomorphic reaches of the San Juan River to characterize stable isotope signatures and caloric content of fishes and resource bases to evaluate sources of energy. Conduct pilot laboratory experiments at KSU, capture and rear fish to be ^{15}N enriched, select study secondary channel. Conduct pilot experiments to evaluate and refine the feasibility of using blocked sections of secondary channels as replicates for field experiments.
Jul. 2004 – Sep. 2004: Conduct first year of field experiments (two trials).
Oct. 2004 – Nov. 2004: Conduct prey behavior and predator consumption experiments in artificial streams
Nov. 2004 – July 2005: Laboratory and data analyses
Jul. 2005 – Sept 2005: Conduct second year of field experiments (two trials).
Oct. 2005 – Nov. 2005: Conduct second year of prey behavior and predator consumption experiments in artificial stream.
Nov. 2005 – Dec. 2006: Complete data analysis and synthesis. Draft and complete project completion report.

Facilities and Equipment available at Kansas State University
Artificial Stream system located at Konza Prairie Biological Station (12 riffle/pool units are currently in place and another 12 units are expected to be running by December 2002)
Wet lab (1100 ft2) with fiberglass holding tanks and carbon filter water conditioning system
ThermoFinnigan Delta Plus mass spectrometer
Parr semi-microbomb calorimeter w/2 bombs
Large capacity drying oven
Ohaus digital analytical balance
Compound and dissecting microscopes

BUDGET

2003 - 2004:

Personnel	KSU (research technician, 1 month summer salary for Gido, undergraduate assistant to run calorimeter)	30,000
	NMDG&F	5,000
Per diem and travel		3,000
Equipment and supplies	(Chemicals, seines, block nets, isotope and bomb analysis, etc.)	7,000
Overhead	(20% of KSU budget)	8,000
	Total FY 2002 – 2003	**53,000**

2004 - 2005:

Personnel	KSU (research technician, 1 month summer salary for Gido)	25,000
	NMDG&F	10,000
Per diem and travel		5,000
Equipment and supplies	Chemicals, seines, block nets, isotope analysis, etc.)	5,000
Overhead	(20% of KSU budget)	6,000
	Total FY 2003 - 2004	**$51,000**

2005 - 2006:

Personnel	KSU (research technician, 1 month summer salary for Gido)	25,000
	NMDG&F	10,000
Per diem and travel		5,000
Equipment and supplies		5,000
Overhead	(20% of KSU budget)	6,000
	Total FY 2004 – 2005	**51,000**
Grand Total Budget		**$155,000**

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Assessment of Colorado Pikeminnow Augmentation in the San Juan River

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Background:

In 1996 and again in 1997, approximately 100,000 young-of-year (YOY) Colorado pikeminnow were stocked in the San Juan River to characterize survival, growth, and retention in the river and quantify and characterize nursery habitat used by stocked fish, (Trammel and Archer 2000). This experiment showed that habitat for young Colorado pikeminnow was available and reasonably common in the San Juan River, that YOY survived for at least 2 years, grew up to 250 mm TL, and that a large proportion remained in the river, rather than dispersing to Lake Powell. Differences in survival and retention were noted as related to storm events and flow patterns. Storm events and runoff events tended to reduce survival and move the fish downstream. Fish in the lower river tended to be more susceptible to flow-induced changes in survival and retention than fish in the upper river.

Based on the success of this experimental study, the SJRIP plans to stock 200,000 or more YOY Colorado pikeminnow into the San Juan River annually (Ryden 2002) with the intent of developing an adult population capable of sustaining itself in the river and meeting the recovery goals of 800/1,000 adult Colorado pikeminnow (USFWS 2002). In addition, an important objective of the current augmentation program is to establish Colorado pikeminnow in the area above Shiprock, New Mexico, especially the area above the PNM Weir. Development of the aforementioned adult Colorado pikeminnow recovery goals (USFWS 2002) was based on the

assumption that Colorado pikeminnow could be expanded into this area to utilize the abundant available forage (native suckers and dace). Information on factors that contribute to survival, retention, and growth in this portion of the San Juan River is especially important to the ability of the SJRIP to achieve the recovery goals for this species.

Beginning in 2002, young Colorado pikeminnow will be stocked annually in October or November, to avoid late summer and fall monsoonal storm events. Under existing sampling/monitoring programs (Propst et al. 2000), stocked YOY Colorado pikeminnow would only be sampled once within the first year after release, primarily during the following September or October. Thus, monitoring will provide information on survival after a year in the wild, but it will not provide information on survival, reasons for mortality, or distributional shifts during the first year, information that may be useful in fine-tuning stocking protocols for this species.

During a SJRIP Biology Subcommittee meeting with the Peer Review Panel on September 5, 2002, the need for additional sampling of the stocked Colorado pikeminnow was discussed. Although no conclusions were drawn, the Peer Review Panel and some of the Biology Committee members present noted that understanding mortality factors during the first year may be important in developing populations of this species in the San Juan River. The absence of a study plan specifically designed to track the success of this augmentation program was the stimulus for submission of this research project.

This scope of work proposes monitoring the YOY Colorado pikeminnow during the first year after stocking to more clearly understand factors affecting survival, growth, and retention in the San Juan River. It is anticipated that results of this study will assist in refining augmentation activities for this species. The overall goal of the study is to characterize survival of stocked Colorado pikeminnow and what, if any, changes should be made to the augmentation program to increase survival. In subsequent years, it is likely that some 1- and 2-year-old stocked Colorado pikeminnow may be captured, adding information on their survival, growth, and retention. Fish stocked in 1996 and 1997 tended to disappear from SJRIP samples after their second year in the river (D. Ryden, USFWS, personal communication). This disappearance may be due to a habitat shift making them much more difficult to capture or to some mortality factor. Additional sampling may assist in determining what is happening to stocked Colorado pikeminnow of this size (age).

Study Area:

The study area for this study will be the San Juan River from Sand Island, Utah to near Bloomfield, New Mexico. Eight stations will be utilized to represent the study area, two in Geormorphic Reach 6 near Farmington, two in Reach 3, one each in Reaches 4, 5, and 7, and one in the lower Animas River. Each station will be 3-5 miles long and be accessible without long floats, except the lower Animas station which will be about 2 miles long and access will be via vehicles.. Reaches 1 and 2 will not be sampled as they are difficult to access, requiring several days to access and sample a single station, and did not show good retention in the 1996 and 1997 study (Trammel and Archer 2000).

The upper-most station will be above the upper stocking area (near the mouth of the Animas River) near Bloomfield, New Mexico. Young Colorado pikeminnow were found over 7 miles above the Shiprock stocking location in 1997 (Trammel and Archer 2000), and a station in Reach 7 will be used to determine if upstream movement occurs from the stocking near Farmington. Similarly, the lower Animas River station will sample the portion of the Animas River that would be accessible to upstream movement of stocked Colorado pikeminnow. This is the lower 2 miles of the river below a new diversion structure along the Riverwalk Park. Two stations are planned for Reach 6, one in the area from the Fruitland Diversion to near the Hatch Trading Post, and the

second from the APS Weir to the Hogback Diversion. The station in Reach 5 will be in the Shiprock area. The station in Reach 4 will be in the Four Corners area. The stations in Reach 3 will be in the Aneth to Montezuma Creek area and the Bluff to Sand Island area.

Objectives:

Objectives of the study are:

1. Characterize survival, growth, and retention of stocked YOY Colorado pikeminnow during the first year after stocking in the San Juan River,

2. Identify factors such as river flow, storm events, and canal locations, with emphasis on the area above the PNM Weir, that are related to high or low survival of stocked YOY Colorado pikeminnow during the first year after stocking.

3. Make suggestions for fine tuning augmentation protocols for Colorado pikeminnow to improve survival, growth, and retention.

Methods:

Three sampling trips will be made to the study area between November 2002 and October 2003 following stocking of YOY Colorado pikeminnow. The first trip will be approximately 1 month following stocking, most likely in November or early December 2002. The second will be post-winter but pre-runoff, most likely in March, 2003, and the third will be in mid summer, July or August, 2003. Trips will be scheduled to avoid periods of changing flow conditions.

During each trip, each of the eight sampling stations will be sampled for one day. Access to the stations will be made with a jon boat. Within each station, as many backwaters, shoals, and other low-velocity habitats available for young Colorado pikeminnow (Trammel and Archer 2000) will be sampled as is practicable in a day. Sampling will be conducted using a 4m x 2m x 3mm or a 9m x 2m x 6mm double-weighted seine. Information collected at each seining location will include: river mile location, GPS location (UTM), habitat type, seine type, area sampled (length and width), average depth, maximum depth, and substrate type. All fish collected, except for small larvae, will be identified to species and counted. A minimum of 50 randomly selected individuals of each species will be measured at each station except for Colorado pikeminnow, which will all be measured. This will provide information on the general size and age of the fish that are collected at each station and during each sampling trip. Native fishes will be returned to the habitat alive, and nonnative fishes will be retained. A separate data sheet will be used for each seine location. Multiple seine hauls may be made in large (>100 m^2) habitats. The emphasis will be to take as many samples as possible rather than to gather detailed information on each fish captured.

It is anticipated that data on stocked Colorado pikeminnow will also be obtained during the annual April-June razorback sucker larval fish and July-September larval Colorado pikeminnow surveys currently being conducted under the SJRIP. Collection efforts for these two larval fish studies are concentrated in the lower reaches of the San Juan River, thereby providing supplemental geographic coverage to that proposed in this research effort. As University of New Mexico personnel responsible for the two aforementioned larval fish studies are also co-principal investigators on this proposal, we expect seamless integration of data between the respective projects.

Data analysis will include an evaluation of changes during the course of the year in YOY Colorado pikeminnow catch rate, size, and location in the river. Information from the razorback

sucker spring-summer sampling, as well as the September-October standardized monitoring, will be included in the analysis to provide a complete first year picture of the fate of the stocked fish. As the fish grow, information from the large bodied fish electrofishing surveys will also be added. Changes in YOY Colorado pikeminnow catch rates will be compared with factors such as flow, river location, presence of canals, and other factors that may influence survival, growth, or retention. Potential changes to the augmentation program will be made based on the results of the study, especially if survival, growth, or retention are not within the range of expected results as noted in the Augmentation Plan (Ryden 2002).

BIO-WEST personnel will have the lead role in the study. Mr. Michael Golden will be the team leader. Personnel from NMGF and UNM will assist with field collection efforts and provide equipment as necessary. A standard field crew of four people is anticipated.

The study is planned for a minimum of 3 years to allow for an evaluation of the various factors that may be impacting YOY Colorado pikeminnow survival.

Products:

Letter-type trip reports summarizing what was found will be prepared following each trip. These short reports will be sent to the Biology Committee via the listserver once data have been preliminarily analyzed.

The annual draft report for 2003 will be prepared and distributed to the SJRIP Biology Committee on or before March 31, 2004. Upon receipt of comments, a final report will be prepared on or before June 1, 2004, and provided to the SJRIP for distribution. All data will be presented in a Microsoft Access database and provided to the SJRIP for inclusion in the standardized database by March 31, 2004.

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2003 BUDGET: Note: This budget assumes funding will be provided by early December 2002 so the first sampling trip can be conducted at that time. If funding is not approved until after December 2002, the November/December 2002 trip funds will be applied to a trip in November/December, 2003.

BIO-WEST		
	Labor (1029 man hrs)	53,550
	Travel (102 days per diem, 4,800 miles)	10,200
	Equipment and Supplies	3,105
	Total	**$ 66,855**
NMDGF		
	Labor (36 days @ $250/day)	9,000
	Travel (33 days @ $65/day & 3000 miles @ $.50/mi)	3,645
	Equipment & Supplies	500
	Subtotal	13,145
	Overhead (10%)	1315
	Total	**$ 14,460**
UNM		
	Labor - Field Research Technician (22 staff-days @ $250/day)	5,500
	Travel and per diem	
	Mileage (will drive with NMGF)	0
	Field per diem (18 staff-days @ $50/day)	900
	Equipment & Supplies (will use equipment and supplies funds from existing UNM-SJR projects)	0
	Subtotal	6,400
	Administrative Overhead (15%)	960
	Total	**$ 7,360**
GRAND TOTAL		**$ 88,675**

Out-year Funding (based on 5% annual increase):

Fiscal Year 2004	$93,109
Fiscal Year 2005	$97,764

RECOVERY ACTIONS

Non-Native Species Monitoring and Control
Fiscal Year 2003 Workplan Proposal

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Background:

During 1991-1997, nonnative species studies on the San Juan River focused on the identification of impacts to native fishes. Research characterized the distribution and abundance of non-native species in main channel habitats, seasonal movements of channel catfish and common carp, the food habits of non-native predators, primarily channel catfish, the overlap of resource use between native and non-native fish species, and the relation of these findings to differing flow regimes. Channel catfish were the single most abundant large non-native predator in main channel collections. Data indicated that channel catfish occupied a variety of habitats within the main channel, generally exhibited localized movement, and at lengths > 450 mm TL preyed upon native species.

The emphasis of removal of channel catfish and common carp was placed on a portion of Reach 6 (PNM weir to Hogback Diversion) and was designed to address removal or minimization of the reproductive effort in the upper portion of the species' occupied range. Mechanical removal efforts employed during 1998-2001 removed more than 12,000 channel catfish and 8,000 common carp. Analyses of 1998-2001 data illustrated the decline in the abundance of channel catfish > 300 mm TL, presumably due to removal efforts, throughout the study area. Common carp, on the other hand, did not change in distribution and abundance or size class structure.

Given the popularity of channel catfish as a sport fish and the concerns expressed by the public regarding disposal of removed fish, a program to transplant removed fish to isolated fishing impoundments was initiated in 1998 and continued through 2001. Channel catfish were removed by raft-mounted electrofishing gear and transplanted by State of New Mexico hatchery truck to closed impoundments managed for recreational fisheries. This effort was strongly supported by the the State of New Mexico and the local public.

This workplan proposes to continue mechanical removal of channel catfish and other non-native species in conjunction with main channel adult monitoring and rare fish stocking efforts. Monitoring data on the distribution, abundance, and food habits of non-native species will be collected and analyzed. Data analyses of channel catfish abundance in collections and capture rate by size class will be employed to identify target catch per unit effort by size class. Sustained attainment of a target catch per unit effort in upstream reaches will be used to trigger a shift in removal emphasis

to the next downstream reach. Transplantation of San Juan River channel catfish to isolated impoundments currently used for recreational fisheries will be continued.

Objectives:

1.) Continue data collection and mechanical removal of non-native species during main channel adult rare fish monitoring efforts.

2.) Evaluate distribution and abundance patterns of non-native species to determine effects of mechanical removal on abundance and distribution patterns.

3.) Continue transplantation of channel catfish to fishing impoundments isolated from the San Juan River.

4.) Characterize the distribution and abundance of striped bass into the San Juan River upstream of Lake Powell during removal efforts and determine predative impacts via stomach content analysis.

5.) Develop catch per unit effort targets for use in evaluation of mechanical removal in discrete river reaches.

Methods:

Mechanical removal will continue during the fall main channel monitoring efforts. During these sampling efforts, all nonnative species collected will be sacrificed and data recorded for species identification and enumeration, ontogenetic stage (young-of-year, sub-adult, adult) at non-designated miles, and standard and total lengths and weight at designated miles. Data will be summarized by geomorphic reach and sampling will occur two out of every three river miles. Data for recaptured channel catfish and common carp tagged during 1993-1996 will be recorded in the field and integrated into existing databases for movement and abundance. Catch per unit effort (CPUE) will be calculated as number of fish collected per minute electrofishing time and be calculated for the total collection and for each species. Analyses will include comparison of 1991-2002 data summaries.

Separate, three day efforts for mechanical removal in the San Juan River reach between PNM Weir and Hogback will occur biweekly during February, March, and April 2002, prior to spring high flow. Due to increases in discharge and turbidity, sampling efficiency decreases during high flow periods. Sampling trips will be conducted when deemed suitable for maximum removal success. Biweekly sampling will resume when high flow conditions recede in late summer and fall until a total of 10 trips are conducted. If a significant reduction in abundance and distribution is observed and meets target catch rate criteria, sampling efforts will shift downstream to the next distinct reach, Hogback to Shiprock.

Sampling will be by two electrofishing rafts and captured channel catfish will be measured (nearest 1 mm) for standard and total lengths, weighed (nearest 1 g), and, if not sacrificed for study purposes, transported by hatchery truck to isolated recreational angling impoundments in the Four Corners region. All other nonnative species sampled during these efforts will be sacrificed and appropriate data recorded for location, length/weight, and, for lacustrine predators, stomach contents. Total and individual daily CPUE will be calculated to evaluate efforts of short-term suppression efforts to locally deplete non-native species numbers.

Striped bass control efforts will be combined with other mechanical removal efforts unless high abundance and distribution patterns observed post spring runoff 2000 are encountered during 2001 and 2002. If it is determined that abundance and distribution are high, based upon spring sampling for both mechanical removal efforts and razorback sucker monitoring, specific removal efforts will be employed between Farmington, New Mexico and Bluff, Utah. Two sampling efforts during July and August after cessation of high flows will be employed, using three electrofishing rafts. All nonnative fishes will be removed. Lacustrine non-native species (primarily striped bass, walleye, largemouth bass) collected in the San Juan River will be sacrificed for stomach content analysis and determination of gender and reproductive status. Stomachs will be removed from each specimen captured and preserved in 10% formalin for lab analyese. Data recorded for each specimen are date, location (RM segment), species, standard and total lengths (nearest 1 mm), weight (nearest 1 g), and sex. Stomach content analyses will identify frequency of occurrence and weight by individual prey species, stomach fullness and relate standard length of identifiable prey species to predator standard length.

Catch per unit effort (CPUE) data will be analyzed for two size classes (adult >300 mm TL, immature< 300 mm TL) of channel catfish to monitor and evaluate changes relative to removal efforts. The objective is to develop a target CPUE for each size class and allow for a shift in removal efforts to the next downstream river reach, once the target is obtained. The target CPUE for channel catfish is currently unknown and will be based upon historic CPUE values for channel catfish and current sampling efforts during 2002.

Deliverables:

Participation will continue in data integration efforts to incorporate 1998-2002 data, produce a summary report, refine flow recommendations as appropriate, and complete revision of SJRRIP planning documents. An electronic data file will be provided for inclusion in the centralized database by 31 March 2004. A summary report detailing findings will be completed in draft by 31 March 2004 for SJRIP Biology Committee review and finalized by 1 June 2004.

Budget (FY 2003):

Personnel:		
Nonnative species removal/channel catfish translocation (168 mandays)	$	62,700
Laboratory processing of samples (11 mandays)	$	3,900
Reporting/data management (40 mandays)	$	14,900
Subtotal	$	81,500
Travel/per diem:		
Removal/translocation (113 days)	$	8,500
Reporting/data management (12 days)	$	900
Subtotal	$	9,400
Equipment and supplies		
Removal/translocation (generator replacement, equipment maintainance)	$	5,000
Miscellaneous (administrative supplies)	$	1,500
Subtotal	$	6,500
T0TAL	$	97,400
Administrative Overhead (20%)	$	19,480
Funding for participation of other agencies:		
New Mexico Department of Game and Fish - Santa Fe	$	10,000
U.S. Fish and Wildlife Service - Grand Junction	$	5,000
Utah Division of Wildlife Resources - Moab	$	5,000
GRAND TOTAL	**$**	**136,880**

Outyear Funding (with 5% increase included):

Fiscal Year 2001	$	117,240
Fiscal Year 2002	$	130,040
Fiscal Year 2004	$	143,369
Fiscal Year 2005	$	150,537
Fiscal Year 2006	$	158,064
Fiscal Year 2007	$	165,967

Non-Native Species Control in the Lower San Juan River
Fiscal Year 2003 Project Proposal

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Background:

Non-native species prey upon and compete with native species, resulting in the decline of the native population. Large predacious species introduced as sport fish into reservoirs have increasingly made their way into the riverine habitat that has historically been the domain of native fish. Northern pike, walleye, largemouth bass, and sunfish are some examples of sport fish that have been found in the Green and Colorado rivers.

In 1995 mechanical removal efforts were initiated by the U.S. Fish and Wildlife Service to target non-native species in the San Juan River. Channel catfish were the main focus of these removal efforts, as they occupy a variety of habitats within the main channel, and prey on the native fish community. Data from 1998-2000, collected by USFWS, had shown a decline in the abundance of channel catfish > 300 mm TL in the study area, presumably due to removal actions. Removal efforts continue to take place in a nine mile portion of Reach 6 between the Hogback Diversion Dam and the PNM Weir.

Other non-native species are a concern due to their impact on native species in the San Juan River. Several lacustrine predators are free to move up into the San Juan River from Lake Powell. These include largemouth bass, walleye and striped bass (stripers). Recently, striped bass from Lake Powell have become an issue in the San Juan River. Lake Powell has a large population of striped bass and their life history patterns suggest that they move out of lakes and into lotic waters to spawn in the spring (Lee et al. 1980). Furthermore, their effectiveness as visual predators is likely increased during clear flowing runoff periods. Widespread abundance and distribution of striped bass was observed in July 2000 during electrofishing surveys on the San Juan River. Surveys in the fall of 2000 indicated lower numbers of stripers than had been found previously, but some individuals persisted into October. Electrofishing surveys in 2001 had once again documented the presence of striped bass in the river (Dale Ryden, pers. comm.). The likelihood of stripers preying upon native and endangered fish poses a substantial threat to the recovery of endangered species in the San Juan River. The consistent observation of this species in the San Juan River suggests the need for further study and continued removal efforts to protect the native and endangered fish community in the river.

This work plan proposes to identify when the majority of striped bass tend to move up into the San Juan River, in addition to actively removing them and other non-natives in the lower section of river. It will serve to determine what time frame will be most effective so that more intensive and specific removal efforts may be employed in the future. Removal efforts in the lower river will aid in current efforts further upstream, and hopefully suppress any negative impacts to the endangered and native fish community. Initial efforts for this study are being conducted during 2002 and will continue into 2003, serving as the second year of this study.

Objectives:

1.) Determine when striped bass move out of Lake Powell and into the San Juan River.

2.) Continue mechanical removal efforts of large bodied non-native species in the lower portion of the San Juan River.

3.) Relate striped bass movement out of Lake Powell into the San Juan River to lake levels and river conditions (including flows and turbidity).

4.) Characterize the distribution and abundance of lacustrine predators moving out of Lake Powell into the San Juan River during spring and summer.

Study Area:

The study area for this project includes the San Juan River from Mexican Hat (RM 53) to Clay Hills (RM 2.9), Utah. The river from Mexican Hat to RM 17 is part of Geomorphic Reach 2 and is primarily bedrock confined and dominated by riffle-type habitat. RM 17 down to Clay Hills includes Geomorphic Reach 1 where the river is canyon bound with an active sand bottom. Habitats within this section are heavily influenced by the shifting thalweg, changing river flow, and reservoir elevations. This section of river has additionally been identified as important nursery habitat for the native and endangered fish species.

Methods:

Mechanical removal of non-native species will be conducted from Mexican Hat to Clay Hills, Utah. Sampling efforts will be conducted via two raft mounted electrofishing boats. The entire study area will be electrofished in a downstream fashion with one boat on each shoreline. Each boat will have one netter and one rower. Ten trips will be conducted beginning in March, and timing of sampling will be dependent on 2002 data. Bimonthly trips will be conducted during anticipated periods of upstream migration by striped bass. The final trip of the year will occur in October. In an average water year, this schedule will allow for sampling a variety of habitat conditions to further refine this control approach.

All non-natives collected will be identified, enumerated, measured to the nearest mm for total and standard length, weighed to the nearest gram, and removed from the river. Gender and reproductive status of lacustrine species will be determined and approximate location of capture by river mile recorded. Stomach contents of lacustrine species will be examined. Contents requiring microscopic identification will be preserved. Any rare fish encountered will be collected, identified, enumerated, measured to the nearest mm for total and standard length, weighed to the nearest gram, and scanned for a PIT tag. If a PIT tag is not present, one will be inserted. General condition of the fish will be recorded in addition to any parasites or abnormalities. All rare fish collected will be returned to the river at the location in which they were caught. Other native fish will not be netted. Catch rates will be calculated as number of fish caught per hour and river miles will be recorded for approximate collection locality.

General water quality parameters will be recorded including temperature, conductivity, salinity and dissolved oxygen. Daily water discharge and turbidity will be compared to catch rates for

striped bass to determine the relationship between river conditions and movement of these fish upstream.

Costs for other cooperating agencies that may provide personnel and equipment as needed are included in this budget.

Deliverables:

A draft report for the Non-Native Species Control in the Lower San Juan River activities will be prepared and distributed to the San Juan River Biology Committee for review by March 2004. Historical information on nonnative fish species use of the lower San Juan River will be included, to the extent it is available. Upon receipt of written comments, that report will be finalized and forwarded to members of the San Juan River Biology Committee 1 June 2004. Electronic copies of the field and collection data will be transferred to the San Juan River database manager following the successful protocol previously employed.

Budget: FY-2003

Personnel:		UDWR	FWS-Alb	FWS-GJ	NMGF
Biologists (63 days/biologist)	$	16,500	12,600	9,450	3,150
Technicians (2 technicians)	$	15,000			
Project Leader	$	2,600			
Travel/per diem:	$	5,000			
Data Analysis and Reporting :	$	5,250			
Equipment and Supplies:					
Misc.	$	1,000			
Sub-total	$	45,350	12,600	9,450	3,150
Overhead (20%)					
UDWR	$	9,070			
FWS-Alb			2,520		
FWS-GJ				1,890	
NMGF					630
Total	$	54,420	15,120	11,340	3,780
Grand Total -	**$**	**84,660**			

References:

Lee, David S., C. R. Gilbert, C. H. Hocutt, R.E. Jenkins, D. E. McAllister, J. R. Stauffer, Jr.1980. Atlas of North American Freshwater Fishes. North Carolina State Museum of Natural History.

Razorback Sucker Augmentation and Monitoring
Fiscal Year 2003 Project Proposal
updated 28 May 2002

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Background:

Razorback sucker is a federally-listed endangered fish native to the San Juan River. At present this species is rare in the San Juan River. In order to gain information on habitat use, possible spawning areas, and survival and growth rates of hatchery-reared razorback sucker in the wild, it was necessary to experimentally stock a small number of fish. Experimental stocking of razorback sucker into the San Juan River began in 1994, as outlined in An Experimental Stocking Plan For Razorback Sucker In The San Juan River. Between 1994 and 1996, a total of 940 razorback sucker were stocked into the San Juan River by personnel from the U.S. Fish and Wildlife Service's (Service) Colorado River Fishery Project (CRFP) office in Grand Junction, Colorado. All fish were PIT-tagged before release into the wild. Based on the success of this experimental stocking study the decision was made to implement a full-scale augmentation program for razorback sucker in the San Juan River. Information obtained during the evaluation of stocked razorback sucker will help address objectives 5.1 through 5.5 in the San Juan River Long Range Plan.

In August 1997, a Five-Year Augmentation Plan for Razorback Sucker in the San Juan River was finalized. The five-year augmentation plan, recommended the stocking of 73,482 razorback sucker into the San Juan River between 1997 and 2001. Stocking of razorback sucker from various sources into the San Juan River began in early September 1997. However, between 3 September 1997 and 1 November 2001 a total of only 5,896 razorback sucker were stocked into the San Juan River. If razorback sucker stocked as part of the experimental stocking plan (1994-1997) are included, 6,836 razorback sucker have been stocked into the San Juan River since 1994. The 5,896 razorback sucker stocked as part of the five-year augmentation effort represents a shortfall of 67,586 fish when compared to numbers recommended in the five-year augmentation.

The inability to achieve San Juan River razorback sucker augmentation goals has been due to a suite of circumstances all of which ultimately result in a lack of fish. However, the main problem is that rearing facilities outside of the San Juan River Basin lack the capabilities to hold and rear razorback sucker for the San Juan River Recovery Implementation Program (SJRIP). To alleviate this problem, the SJRIP undertook efforts to obtain or build grow-out ponds within the San Juan River basin that would afford a measure of self-sufficiency (for holding/rearing fish) to the San Juan River razorback sucker augmentation program. Beginning in 1997, a series of grow-out ponds were established on NAPI lands southwest of Farmington, New Mexico. Presently there are about 16 surface acres of grow-out ponds (i.e., nine individual ponds) being used to rear razorback sucker. An additional nine acres of grow-out ponds are scheduled to be built in fall/winter 2002-2003.

Another problem when trying to meet target stocking numbers set forth in the augmentation plan is that, in many years, the number of excess razorback sucker available to the SJRIP from Upper Colorado River Basin (UCRB) recovery efforts are not sufficient to make up for shortfalls and achieve the goals prescribed in the augmentation plan. One approach currently being employed to address problem is to obtain razorback sucker larvae from Willow Beach and Dexter National Fish Hatcheries (NFH). These larval fish are progeny of wild Lake Mohave adults being held at those hatcheries. Since the majority of these larvae are produced in March, they need to be temporarily retained until food availability and water temperatures in grow-out ponds are adequate to support them (usually mid- to late-May). Personnel Division of Fishes, Museum of Southwestern Biology (MSB), at the University of New Mexico (UNM) have addressed this concern (under a separate workplan) by establishing temporary holding facilities for larval razorback sucker. The UNM holding facility serves to maintain larvae in the interim (8-10 weeks) between their being obtained from hatchery facilities and a time when water temperatures at grow-out ponds increases to a sufficient level for rearing. These larvae will then be stocked in three of the nine available grow-out ponds (i.e., the two Avocet Ponds and Hidden Pond).

In spring 2002, the remaining six grow-out ponds were stocked with 100-250 mm TL razorback sucker obtained from the Service's 24-Road hatchery and the state of Colorado's Mumma hatchery. These razorback sucker were excess fish that were being culled from the UCRB razorback sucker broodstock lots. In subsequent years, larval razorback sucker from various sources (i.e., Dexter NFH, 24-Road hatchery, others) will be used to stock these six ponds, as they become available.

Because of the large shortfall in numbers of stocked fish during the 1997-2001 augmentation effort, the San Juan River Biology Committee adopted an addendum to the 1997 stocking plan that extends the intensive stocking period for razorback sucker for an additional eight-year period, beginning in 2004 and continuing through 2011. This addendum calls for stocking a minimum of 11,374 razorback sucker per year, with the goal of establishing an adult population of 5,800 adult razorback sucker in the San Juan River.

Larval razorback sucker stocked into the grow-out ponds in spring 2003 (as well as holdover fish from previous years' harvest efforts) will be harvested beginning in fall 2004 for this eight-year augmentation effort. This time-table allows for the additional nine acres of grow-out ponds to be constructed and stocked with larval fish in spring 2003. These fish will then have the requisite two growing seasons necessary to attain $\geq$ 300 mm TL before they are harvested in fall 2004 for the beginning of the new eight-year augmentation effort.

In the interim between the two augmentation efforts (i.e., during 2002 and 2003), the nine grow-out ponds currently in use will be sampled in the fall and fish $\geq$ 300 mm TL will be selectively removed, PIT-tagged, and stocked into the San Juan River. This selective removal of larger fish from grow-out ponds will allow for accelerated growth of smaller razorback sucker remaining in the grow-out ponds. In addition, razorback sucker stocked in 2002 and 2003 will help boost numbers of adult razorback sucker in the river between the two augmentation efforts.

Description of Study Area:

Razorback sucker will be reared in grow-out ponds southwest of Farmington, New Mexico for two full growing seasons (to TL $\geq$ 300 mm), at which time they will be harvested, PIT-tagged,

and stocked into the San Juan River at RM 158.6, just downstream of the Hogback Diversion (between Farmington and Shiprock, New Mexico).

The study area for monitoring razorback sucker stocked into the San Juan River extends from RM 158.6 downstream to RM 76.4 (Sand Island boat landing) near Bluff, Utah.

Objectives:

1.) Obtain, rear, harvest, and stock razorback sucker to fulfill tasks and objectives outlined in the current version of the razorback sucker augmentation plan (2002 *draft*)

2.) Monitor stocked razorback sucker in the wild for various parameters, including:
   a) Spawning season habitat use and movement patterns
   b) Survival and growth rates
   c) Determine whether hatchery-reared razorback sucker will recruit into the adult population and successfully spawn in the wild

Methods:

USFWS personnel will coordinate the obtaining of larval razorback sucker from Willow Beach and Dexter NFH during March and April 2003. Larval razorback sucker obtained from hatchery facilities will be transferred to the interim rearing facility at MSB with handling and transport following existing U. S. Fish and Wildlife Service protocols. Under a separate workplan, growth and survival will be tracked during the rearing tenure at MSB. CRFP personnel will determine when it is appropriate to transfer larval razorback sucker from the interim MSB holding facilities to grow-out ponds (presumably late May to early June). This transfer and disposition of larvae will be determined and coordinated by CRFP personnel with the assistance of MSB personnel.

CRFP personnel will coordinate obtaining any excess larval or juvenile razorback sucker that may become available from UCRB recovery efforts (e.g., those from the 24-Road hatchery). CRFP personnel will transport these fish and stock them in the appropriate grow-out pond.

Razorback sucker will be reared at grow-out ponds for two full growing seasons. Maintenance of water level and monitoring of pond water quality will be performed by BIA-NIIP personnel (This function may be taken over by Navajo Game and Fish in future years). In the fall, razorback sucker $\geq$ 300 mm TL will be harvested (using fyke nets, trammel nets, or other appropriate gear), PIT-tagged, and stocked into the San Juan River just downstream of Hogback Diversion (RM 158.6).

CRFP personnel (along with personnel from cooperating agencies) will monitor stocked fish on two electrofishing/netting trips in 2003. One trip will sample RM 158.6-76.4, followed shortly thereafter by the second trip that will sample RM 76.4-2.9. These two sampling trips will occur on the ascending limb of the hydrograph, from late April to late May. Electrofishing, seining, and trammel netting will be used to determine dispersal, and survival of stocked fish. The fall 2002 main channel fish community monitoring trip will act as a third trip to monitor stocked razorback sucker throughout the year. Survival rates will be determined using either mark-recapture models (e.g., Program CAPTURE, MARK, Schnabel, Petersen) or age/growth curves or a combination of

the two. Electrofishing and handling of rare fish species will follow the protocol found in the main channel fish community monitoring workplan, except that only data on rare fish species collected (i.e., razorback sucker, Colorado pikeminnow, and roundtail chub) will be recorded. When rare fish species are collected, PIT tag number, length, weight, reproductive status (if evident), and information about health abnormalities (if any) will be recorded.

In support of Objectives 4 and 6, up to eight razorback sucker may be implanted with radio transmitters (one-year lifespan) on 2002 sampling trips. These fish will be tracked throughout the suspected spawning season for razorback sucker in the San Juan River (i.e., late March though mid-June). Tracking trips will be conducted on a monthly basis (a minimum of four trips) from March to June. If spawning aggregations of razorback sucker are identified, trips will be done on a more frequent basis, concentrating on the groups of spawning fish. Fish contacted in aggregations during suspected spawning seasons will be tracked for a minimum of one hour each. At the end of these contacts, all riverine habitats for 100 meters both up- and downstream of the most up- and downstream fish locations during the contact period will be mapped on hardcopies of aerial videography. All habitats utilized by the fish will be recorded as well as the amount of time spent in each particular habitat type. Once back from the field, relative percentages of habitats available and habitats used will be determined, so that habitat selection can be determined as in previous razorback sucker telemetry studies on the San Juan River. During hour-long radiotelemetry contacts, detailed habitat information on substrate, depth, cover, and velocity at the fish's most frequented location will also be recorded. Water quality parameters including dissolved oxygen, water temperature, conductivity, and pH will be measured at each contact location. At the end of a radio telemetry contact, attempts will be made to recapture radiotelemetered fish via trammel netting and/or seining. Recapture efforts will be aimed at gaining data on age, growth, and sexual status as well as trying to recapture any other razorback sucker that might be aggregating with radiotelemetered fish. If spawning aggregations of razorback sucker are identified, crews from other research elements monitoring razorback sucker larval drift (i.e., Steven Platania) and habitat quality and quantity (i.e., Ron Bliesner and Vince Lamarra) will be notified.

Mechanical removal of nonnative fish species will continue to take place on all razorback sucker monitoring trips.

The Service (CRFP) will have the lead for the razorback sucker monitoring with the New Mexico Department of Game and Fish providing field personnel and equipment for monitoring trips. Other cooperating agencies may provide personnel and equipment for these trips as needed.

Products:

An interim progress report for razorback sucker monitoring trips conducted in 2003 will be completed by 31 March 2004. A "draft final" incorporating all comments received will be completed by 1 June 2004. DBASE IV files containing information on total catch and length/weight data gathered for rare fish species will be submitted to Keller-Bliesner Engineering for inclusion on the SJRIP integrated database CD-ROM by 31March 2004.

Fiscal Year 2003 Budget:

Personnel	
Objective 1 (42 man days): grow-out pond work	$ 8,920
Objective 2 (40 man days): radio telemetry	$ 8,490
Objective 2 (35 man days): electrofishing	$ 7,430
Subtotal	$24,840
Travel and Per Diem (25 days)	$ 5,300
Data Analysis and Reporting (35 days)	$ 7,560
Subtotal	$12,860
Equipment and Supplies--i.e., fuel and maintenance, repair, replacement of: Field equipment: stocking truck, water pump, nets, PIT tag gear, rafts and jon boats, outboard motors, radio receivers, trucks, etc.***	$ 2,000
Total	$39,700
Service Administrative Overhead (20.00%)	$ 7,940
U.S. Fish and Wildlife Service-CRFP Total	$47,640
Funding for field assistance from NM Dept. of Game and Fish	$ 2,000
PIT Tags (5,000 tags)	$20,000
GRAND TOTAL	**$69,640**

*** The 'Equipment and Supplies' costs listed here represent the costs anticipated to be incurred by CRFP in FY-2003 for performing our own field work as well as providing equipment for other agencies (UDWR-Moab and USFWS-Albuquerque) with whom we are cooperating on approved SJRIP projects. Our total anticipated cost for 'Equipment and Supplies' in FY-2003 (i.e. $6,000) has been divided evenly and distributed across three CRFP workplans, of which this workplan is one.

Previous Years' Funding:

Fiscal Year 1997	$41,200
Fiscal Year 1998	$44,000
Fiscal Year 1999	$50,700
Fiscal Year 2000 (includes purchasing large number of PIT tags)	$86,240
Fiscal Year 2001	$62,600
Fiscal Year 2002	$67,600

Estimated Outyear Funding (based on an annual 5% increase as agreed upon by the SJRIP Biology Committee at their 21 May 2002 meeting):

Fiscal Year 2004	$73,100
Fiscal Year 2005	$76,800
Fiscal Year 2006	$80,600
Fiscal Year 2007	$84,650
Fiscal Year 2008	$88,900

Radio-Tracking of Stocked Adult Colorado Pikeminnow in the San Juan River
Fiscal Year 2003 Project Proposal
updated 6 June 2002

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Background:

Colorado pikeminnow is a federally-listed endangered fish native to the San Juan River. The capture of low numbers of Colorado pikeminnow of all life stages over the past ten years has confirmed that a small, but reproducing population of Colorado pikeminnow still exists in the San Juan. In 1996, experimental stocking of Colorado pikeminnow into the San Juan River was undertaken by the Utah Division of Wildlife Resources (UDWR). Between 1996 and 2000, approximately 827,000 larval and age-0 Colorado pikeminnow were stocked into the San Juan River by UDWR. In following years, several hundred experimentally stocked fish were recaptured during subsequent monitoring efforts. Based on data collected from experimentally stocked fish, it is apparent that stocked, hatchery-reared Colorado pikeminnow can survive in the San Juan River and can provide a viable method of supplementing the numbers and expanding the range of the wild San Juan River Colorado pikeminnow population.

On 11 April 2001, the U.S. Fish and Wildlife Service stocked 148 adult Colorado pikeminnow into the San Juan River at RM 178.8. These fish, which averaged 539 mm TL at time of stocking, were excess fish being culled from Upper Basin Recovery Program broodstock lots being held at Dexter National Fish Hatchery (NFH). Eight of these fish were implanted (in fall 2000) with four-year life-span radio transmitters. The purpose of this stocking was to determine the feasability of using stocked adult Colorado pikeminnow to expand the range of the San Juan River Colorado pikeminnow population into river sections upstream of the Hogback Diversion (RM 158.6). To this end, information will be collected, via radio telemetry and electrofishing recaptures, on survival, dispersal, movements, habitat use, and possible spawning behavior among stocked adult Colorado pikeminnow.

The need for artificial propagation and augmentation of Colorado pikeminnow in the San Juan River is apparent for several reasons. Augmentation will help increase population numbers, provide more individuals for research purposes (as in the case of this study), add genetic diversity to the existing gene pool, and provide a riverine refugia population that will, hopefully, at least remain stable until further research can identify factors limiting successful recruitment of this species in the San Juan River. The San Juan River Long Range Plan identifies the need to assess the feasibility of, and then implement the augmentation of Colorado pikeminnow. In 2002, a plan for augmenting this species in the San Juan River will be finalized to provide the necessary guidance for augmentation efforts as well as directly fulfilling objective 5.3.8.2 of the San Juan River Long Range Plan. While this augmentation plan will be based predominately on

stocking juvenile life stage Colorado pikeminnow, adult Colorado pikeminnow will also be stocked into the San Juan River as they become available to the SJRIP.

Objectives:

1.) Determine the feasability of using stocked adult Colorado pikeminnow to expand the range of the San Juan River Colorado pikeminnow population into river sections upstream of the Hogback Diversion (RM 158.6).

Task 1: Track stocked adult Colorado pikeminnow implanted with radio transmitters to determine survival, dispersal, movements, habitat use, and possible spawning behavior.

Methods:

Objective 1: Tracking trips will be conducted on a monthly basis from April to October. If spawning aggregations of Colorado pikeminnow are identified, trips will be done on a more frequent basis, concentrating on the groups of spawning fish. If fish are contacted in aggregations during suspected spawning seasons, they will be tracked for a minimum of one hour each. At the end of these contacts, all riverine habitats for 100 meters both up- and downstream of the most up- and downstream fish locations during the contact period will be mapped on hardcopies of aerial videography. All habitats utilized by the fish will be recorded as well as the amount of time spent in each particular habitat type. Once back from the field, relative percentages of habitats available and habitats used will be determined, so that habitat selection can be determined (as was done in previous radio telemetry studies performed on razorback sucker in the San Juan River). During hour-long radiotelemetry contacts, detailed habitat information on substrate, depth, cover, and velocity at the fish's most frequented location will also be recorded. Water quality parameters including dissolved oxygen, water temperature, conductivity, and pH will be measured at each contact location. At the end of a radio telemetry contact, attempts will be made to recapture radiotelemetered fish via trammel netting and/or electrofishing. Recapture efforts will be aimed at gaining data on age, growth, and sexual status as well as trying to recapture any other Colorado pikeminnow that might be aggregating with radiotelemetered fish. If spawning aggregations of adult Colorado pikeminnow are identified, crews from other research elements monitoring Colorado pikeminnow larval drift (i.e., Steven Platania) and habitat quality and quantity (i.e., Ron Bliesner and Vince Lamarra) will be notified.

FY-2003 is the third year of a four-year radio telemetry effort.

Products:

An interim progress report detailing the field activities performed in 2003 will be produced by 30 March 2004. A "draft final" of this report, incorporating all comments received will be completed by 1 June 2004. DBASE IV files containing information on recaptured and radio-tracked Colorado pikeminnow will be submitted to Keller-Bliesner Engineering for inclusion on the San Juan River Recovery Implementation Program integrated database CD-ROM by 31 March 2004.

Fiscal Year 2003 Budget:

Personnel

Objective (84 man days): radio-tracking	$17,900
Subtotal	$17,900
Travel and Per Diem (32 days)	$ 6,900
Data Analysis and Reporting (20 days)	$ 4,250
Subtotal	$11,150
Equipment and Supplies--i.e., fuel and maintenance, repair, replacement of: Field equipment: stocking truck, water pump, nets, PIT tag gear, rafts and jon boats, outboard motors, radio receivers, etc.***	$ 2,000
Total	$31,050
Service Administrative Overhead (20.00%)	$ 6,210
GRAND TOTAL	**$37,260**

*** The 'Equipment and Supplies' costs listed here represent the costs anticipated to be incurred by CRFP in FY-2003 for performing our own field work as well as providing equipment for other agencies (UDWR-Moab and USFWS-Albuquerque) with whom we are cooperating on approved SJRIP projects. Our total anticipated cost for 'Equipment and Supplies' in FY-2003 (i.e. $6,000) has been divided evenly and distributed across three CRFP workplans, of which this workplan is one.

Previous Years' Funding:

Fiscal Year 2001 (costs defrayed under other CRFP workplans)	$ 0
Fiscal Year 2002 (included costs for the stocking age-0 Colorado pikeminnow, now under a separate workplan)	$48,600

Estimated Outyear Funding (based on an annual 5% increase as agreed upon by the SJRIP Biology Committee at their 21 May 2002 meeting):

Fiscal Year 2004	$44,750

Colorado Pikeminnow Fingerling Production
San Juan River
FY-2003

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Background

Once very common throughout the Colorado River Basin, Colorado pikeminnow have declined from historic levels and are now found primarily in the Upper basin of the Colorado River. Various factors have contributed to the decline of the specie including alteration of natural stream flows and temperature regimes, loss of habitat and habitat fragmentation as a result of water development and the introduction of nonnative fish species.

Colorado Pikeminnow are native to the San Juan River. Its historic distribution included the entire mainstem San Juan River up to Rosa, New Mexico, located approximately 25 miles upstream from present day Navajo Dam. Currently the species is considered extremely rare and the small population is estimated at less then 20 adults. This small group of fish has persisted in the San Juan River since the closure of Navajo Dam in 1962. Recent studies being conducted by the San Juan Recovery Implementation Program (SJRIP) indicate that the Colorado pikeminnow is reproducing and recruiting in the river to at least a limited degree, however the low numbers collected do not satisfy recovery goal requirements for the specie. The Recovery criteria calls for a target of 1,000 subadults fish established by the end of a five year down listing period, and 800 adults maintained during the 7 year delisting period. The Upper Colorado River Endangered Fish Recovery Program has recommended that the wild population be increased by augmenting with hatchery produced fish.

Dexter NFH & TC has been the leader in propagating and culturing Colorado pikeminnow (Ptychocheilus lucius) since 1981. The facility maintains several captive stocks as genetic reserves and has successfully produced fish for the Upper and Lower Colorado river basin programs and the SJ RIP. The major emphasis has been on the reproductive biology, broodstock development and culturing fry, fingerlings and adults. This work plan proposes to produce 350,000 fingerlings (50 mm TL) annually for reintroduction in the San Juan River beginning in fiscal year 2003. Funding is also requested to provide proper care of broodstock necessary to successfully carry out this study for future years and aide in restoration of the specie.

Stocking will require coordination with New Mexico FRO, CRFP-Grand Junction, New Mexico Department of Game and Fish, Colorado Division of Wildlife and Utah Department of Wildlife Resources.

Objectives

(1) Produce 350,000 fingerlings (50 mm TL) for stocking in the San Juan River during 2003.

(2) Continue data collection on induced spawning Colorado pikeminnow under controlled conditions.

(3) Evaluate distributions methods of transporting 350,000 Colorado pikeminnow fingerling from Dexter to the San Juan River.

Methods

Broodstock will consist of 400+ (F1) adults. These fish are 1991 year-class progeny from wild adults collected from the Colorado River. A maximum of 40 paired matings (1 female X 1 male) will be spawned during 2003. Given the past history of hormonal induced ovulation, 30 females (75%) should produce viable eggs during a given year. All members of the broodstock are PIT tagged and records of spawning pairs will be maintained at Dexter.

Ovulation will be induced with intraperitoneal injections of common carp pituitary (CCP) at the rate of 4 mg/kg of body weight. When eggs can be expelled using slight pressure, a female will be stripped and milt added from one male. Each individual egg lot will be enumerated and kept separate in Heath trays until hatching occurs, about 96 hours after fertilization.

When eggs begin hatching, larvae will be transferred to hatchery tanks and held until swim-up occurs, five to seven days. Fry will be enumerated and stocked into three earthen ponds ranging from .33 to .35 ha. Fry will be cultured in earthen ponds for 120 days and fingerlings (50 mm TL) will then be available for stocking in the San Juan River during October, 2003.

Budget for 2003

Personnel requirement:

Drain broodstock pond and transferring adults to fish culture building
Inject males and females with hormones
Prepare egg hatching system
Spawn broodstock and return to holding pond
Place eggs in hatching system and care for eggs
Prepared holding tanks for fry
Transfer fry from incubators to holding tanks
Prepare pond to receive fry
Pond management
Transfer swim-up fry from holding tanks to ponds
Daily feeding (including weekends and holidays)
Weekly dissolved oxygen, temperature and pH recordings
Drain fingerling ponds and transfer to fish culture building
Prepare holding tanks for fingerlings
Inventory (weights and numbers) for each pond
Treat fish for parasites if required and/or needed

Subtotal **14,400.00**

Equipment and Supplies:	
Hormones for spawning	500.00
Liquid oxygen and compressed oxygen	250.00
Heating water for hatching eggs (natural gas)	500.00
Heating water for fry to swim-up (natural gas)	500.00
Water quality monitoring equipment	1,250.00
Culture equipment (nets, seines, screens, etc.)	1,000.00
Pond management supplies	1,000.00
Pumping costs (electrical)	5,000.00
Fish feed	1,000.00
Maintenance costs for equipment	1,500.00
Subtotal	**12,500.00**
Reintroduction Costs:	
Salaries	1500.00
Overtime	250.00
Per Diem	500.00
Fuel costs	200.00
Truck maintenance	250.00
Subtotal	**2,700.00**
Broodstock Care and Maintenance	
Personnel requirements:	
Drain broodstock pond and transfer adults to over-winter pond	
Pond management	
Daily feeding (including weekends and holidays)	
Weekly dissolved oxygen, temperature and pH recordings	
Prepare broodstock holding pond prior to spawning	
Subtotal	**15,000.00**
Equipment and Supplies:	
Culture equipment (nets, seines, screens, etc.)	750.00
Pond management supplies	2,500.00
Fish feed	2,000.00
Pumping costs (electricity)	6,750.00
Subtotal	**12,000.00**
Total	**56, 600.00**
15% Administrative Overhead	**8,490.00**
GRAND TOTAL	**$65,090.00**

Stocking of Fingerling Colorado Pikeminnow and Reporting of FY-2003 Results
Fiscal Year 2003 Project Proposal
updated 28 May 2002

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Background:

Colorado pikeminnow is a federally-listed endangered fish native to the San Juan River. The capture of low numbers of Colorado pikeminnow of all life stages over the past ten years has confirmed that a small, but reproducing population of Colorado pikeminnow still exists in the San Juan. In 1996, experimental stocking of Colorado pikeminnow into the San Juan River was undertaken by the Utah Division of Wildlife Resources. The purpose of this effort was to evaluate dispersal and retention of stocked juvenile Colorado pikeminnow as well as determining the availability, use, and selection of habitats critical to early life stage Colorado pikeminnow. Between 1996 and 2000, approximately 827,000 larval and age-0 Colorado pikeminnow were stocked into the San Juan River. To date, several hundred experimentally stocked fish have been recaptured during either seining or electrofishing efforts. Based on data collected from these experimentally stocked fish, it is apparent that stocked, hatchery-reared, juvenile Colorado pikeminnow can survive in the San Juan River and can provide a viable method of supplementing the numbers and expanding the range of the wild San Juan River Colorado pikeminnow population.

The need for artificial propagation and augmentation of this species in the San Juan River is apparent for several reasons. Augmentation of Colorado pikeminnow would increase population numbers, provide more individuals for research purposes, add genetic diversity to the existing gene pool, and provide a riverine refugia population that would, hopefully, remain stable until further research can identify factors limiting successful recruitment of this species in the San Juan River. The San Juan River Long Range Plan identifies the need to assess the feasibility of, and then implement the augmentation of Colorado pikeminnow. In 2002 a plan for augmenting this species in the San Juan River will be finalized to provide the necessary guidance for augmentation efforts as well as directly fulfilling objective 5.3.8.2 of the San Juan River Long Range Plan.

Objectives:

1.) Procure and stock fish according to guidelines set forth in the augmentation plan for Colorado pikeminnow in the San Juan River (2002 *draft*)

2.) Provide a report that gathers information from various sources on fingerling production, numbers of fish stocked, subsequent recaptures during various sampling efforts, and makes recommendations (if necessary) for modifying methods being employed for Colorado pikeminnow augmentation efforts

Methods:

Objective 1: Young Colorado pikeminnow will be reared in grow-out ponds (under a separate workplan) at Dexter National Fish Hatchery (NFH) until late October or early November, at which time they will be harvested and stocked into the San Juan River in river sections specified in the augmentation plan (i.e., between Fruitland diversion and PNM weir; between Hogback diversion and Shiprock bridge). Once young Colorado pikeminnow are transported to the San Juan River, CRFP crews (two crews of two people each and two people to run shuttles) will load them into live wells and transport them downstream via boat, stocking them in several different locations in the two target sections of river. Fish will be stocked in roughly equal numbers in each of the two river reaches. This will allow young Colorado pikeminnow to be introduced into many appropriate low velocity habitats and avoid their grouping up in large numbers and thus becoming more susceptible to predation (e.g., by channel catfish).

Objective 2: After stocking, CRFP personnel will collect information on stocked fish from Dexter NFH (numbers produced, size at stocking, locations stocked at) and on recaptures during subsequent monitoring and sampling efforts by various agencies. This data will be examined to help determine if augmentation efforts are successful. Success will be determined by examining post-stocking dispersal patterns, analyzing age and growth data, and using mark-recapture population estimators to see if target numbers set forth in the Colorado pikeminnow augmentation plan are being met. Results obtained will be used to make recommendations for modifying (if necessary) methods being employed for augmentation efforts in future years.

Products:

An interim progress report detailing the field activities performed in 2003 will be produced by 30 March 2004. A "draft final" of this report, incorporating all comments received will be completed by 1 June 2004. DBASE IV files containing information on stocked and recaptured Colorado pikeminnow will be submitted to Keller-Bliesner Engineering for inclusion on the San Juan River Recovery Implementation Program integrated database CD-ROM by 31 March 2004.

Fiscal Year 2003 Budget:

Personnel	
Objective 1 (6 man days): stocking	$ 1,300
Subtotal	$ 1,300
Travel and Per Diem (12 days)	$ 2,550
Objective 2 (25 days): Data Analysis and Reporting	$ 5,350
Subtotal	$ 7,900
Total	$ 9,200
Service Administrative Overhead (20.00%)	$ 1,840
GRAND TOTAL	**$ 11,040**

Previous Years' Funding:

Fiscal Year 2002 (included costs for radio-tracking of stocked adult pikeminnow, now under a separate workplan)	$48,600

Estimated Outyear Funding (based on an annual 5% increase as agreed upon by the SJRIP Biology Committee at their 21 May 2002 meeting):

Fiscal Year 2004	$11,600
Fiscal Year 2005	$12,200
Fiscal Year 2006	$12,800
Fiscal Year 2007	$13,450
Fiscal Year 2008	$14,100
Fiscal Year 2009	$14,800

Maintenance of an Interim Holding Facility for Larval Razorback Sucker [1]
Fiscal Year 2003 Project Proposal

Principal Investigator: Thomas F. Turner and Heather L. Parmeter
Division of Fishes - Museum of Southwestern Biology
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turnert@unm.edu
hezrap@unm.edu

Background:

The Five-Year Augmentation Plan for Razorback Sucker in the San Juan River, completed and approved in August 1997, provided guidance for re-establishment of this endangered native fish in the San Juan River. The augmentation plan recommended the stocking of 31,800 razorback sucker into the San Juan River during Year 1. However, between 3 September 1997 and 15 October 1998 a total of only 4,164 razorback sucker (progeny from adults from either Lake Mohave, Green River, and San Juan River arm of Lake Powell) have been stocked in the San Juan River (Table 1).

Table 1. Summary of San Juan River razorback sucker stocking efforts.

DATE	NUMBER	SIZE	RELEASE LOCATION	PARENTAL STOCK
3 SEP 1997	1,027	JUVENILE	Hogback Diversion	Lake Mohave
17 SEP 1997	227	JUVENILE	Hogback Diversion	Green River
19 SEP 1997	1,631	JUVENILE	Hogback Diversion	SJR Arm of Lake Powell
22 APR 1998	124	JUVENILE	Hogback Diversion	Green River
28 MAY 1998	(total combined w/ 22 APR 1998)	JUVENILE	Hogback Diversion	Green River
14-15 OCT 1998	1,155	JUVENILE	Hogback Diversion	Ojo Amarillo Pond
TOTAL	4,164			

The inability to achieve San Juan River razorback sucker augmentation goals has been due to a suite of circumstances all of which ultimately result in a lack of fish. Rearing facilities outside of the San Juan River Basin lack the capabilities to continue to hold and rear razorback sucker for

the San Juan River Recovery Implementation Program (SJR-RIP). Given this lack of resources, efforts were undertaken to develop and establish rearing facilities (holding ponds) within this basin thereby affording self-sufficiency to the San Juan River razorback sucker augmentation program.

Unfortunately, water temperatures at San Juan River grow-out ponds (during March-April) have been identified as being too low to sustain razorback sucker larvae. In addition, a structural failure in August 1999 at Ojo Amarillo Pond, in combination with lower than expected rates of survival, resulted in the loss of the majority of razorback sucker available for 1999-2000 augmentation. Even with rehabilitation of Ojo Amarillo Pond, the number of razorback sucker currently available to the San Juan River Recovery Implementation Program (SJR-RIP) will not be sufficient to achieve the goals prescribed in the five-year augmentation plan until the issues of low water temperature at holding ponds is resolved.

In 2001, we donated the use of a re-circulating larval fish holding and rearing facility (=closed-system) to the program for evaluation of this larval razorback sucker interim holding facility pilot project. This system was selected because it had proved successful and in past cyprinid (minnow) rearing projects. The system was able to hold large numbers of individuals and flexible enough to accommodate a range of environmental requirements. In addition, start-up costs for use of the re-circulating larval fish holding was minimal. In FY 2001, the San Juan River Research Program provided funds for maintenance of the closed-system, specimen rearing, personnel costs, and transportation.

We received about 32,000 larval razorback sucker from Dexter National Fish Hatchery and Technology Center on 28 March 2001 and about 20,000 larvae on 11 April 2001 from Willow Beach National Fish Hatchery. As of 30 April 2001, we estimate a survival rate exceeding 95% of the stock received. Most of the Dexter larval razorback sucker had achieved the juvenile developmental stage and are about 15 mm TL (as of 30 April 2001). Larval razorback sucker from Willow Beach, which are about two weeks younger than those from Dexter, had progressed to the metalarval stage and are about 12 mm TL (as of 30 April 2001).

On 16 May 2001, all larval razorback sucker were transported to Farmington for release in Ojo Amarillo and Avocet ponds (water temperature = 21ºC). The survival estimate for the fish from the Dexter spawn (originally 32,000) was between 60-65% (19,200 to 20,800). Conversely, the survival rate for fish from Willow Beach (n=21,000) was higher and estimated to be between 75-80% (15,750 to 16,800). The two lots of fish remained separate throughout the duration of rearing.

The reason for the higher survival rate for Willow Beach fish was that they were held for a shorter period, were not reared to the large size of Dexter fish, and were less concentrated during rearing (first two factors were most important). The greatest loss of Dexter fish occurred during the final two weeks in captivity as those fish exceeded 15 mm TL. They had achieved the juvenile stage of development (for some time) and appeared healthy but for some reason (currently unknown) there was a chronic daily loss of 100-200 individuals. Water quality was not an issue (at least for the parameters being checked) and fish continued to feed up until death.

The 2001 study demonstrated that the closed-system rearing facility was an efficient means for the temporary rearing of large numbers of larval razorback sucker. The facility was designed to maintain larvae in the interim (8-10 weeks) between hatching and a time when water temperatures

at Ojo Amarillo and Avocet ponds increases to a level sufficient for rearing of larvae. The success of this project provided a viable source of larval razorback sucker that can be used for the augmentation effort of this species and goals delineated in the program document.

For FY 2002 and subsequent years (up to FY 2007), the San Juan River Biology Committee is committed to increasing its razorback sucker augmentation abilities. Numerous grow-out ponds have been construction on the Navajo Reservation (San Juan River Biology Committee meeting 16 May 2001 –meeting summary). In addition, options regarding establishment of ponds on property of private citizens are also being explored. Regardless of the ultimate distribution of razorback rearing ponds, the need for interim holding facilities has been identified as a critical need to augmentation. The goal (starting in FY 2002) is to rear at least 150,000 larval razorback sucker annually for release to rearing ponds and ultimately introduction to the San Juan River.

A one-time designation of funds for construction of a rearing system capable of maintaining 150,000 larval razorback sucker was provided in the FY 2002 budget. The new aquarium based system (again a closed-system) was completed in time to accept the 150,000 larval razorback sucker projected for spring 2002. On 1 April 2002, 20,000 razorback sucker larvae from the Willow Beach National Fish Hatchery were transported to the new rearing facility while 50,000 larvae arrived from Dexter National Fish Hatchery and Technology Center on 10 April 2002. To date (30 April 2002) survival has been good and larvae are growing rapidly.

Costs in subsequent years (i.e., FY 2003 on) for this project are much less than in FY 2002 as the system has been completed and only funds for maintenance and upkeep (in addition to annual costs associated with rearing = salary and supplies) are required.

Description of Study Area:

Larval razorback sucker will be obtained from available sources (i.e., Lake Mohave, Willow Beach National Fish Hatchery, Dexter National Fish Hatchery and Technology Center) and transported to interim rearing facilities at the University of New Mexico. The rearing facility will need to be re-configured to hold and rear up to 150,000 larval razorback sucker for a period of between 6-10 weeks. Water temperature information acquired from Ojo Amarillo and Avocet ponds suggest that by mid-May or early-June water temperatures will have achieved a sufficient level to sustain larval razorback sucker. These data indicate that the interim holding facilities should be prepared to accommodate larvae for at least 6 and up to 10 weeks. The goal will not be to hold larval fish in the interim facility for a pre-determined time period but instead to establish them in the more natural conditions of rearing ponds as soon as conditions allow.

Objectives:

1.) Short term rearing of up to 150,000 larval razorback sucker available from various sources
2.) Transfer reared larval razorback sucker to rearing ponds
3.) Continued assessment of success of interim rearing effort

Methods:

Members of the U.S. Fish and Wildlife Service's Colorado River Fishery Project Office in Grand Junction (CRFP-GJ), Colorado will coordinate the distribution of larval razorback sucker during March and April and spawning of brood stock adult razorback sucker at Willow Beach National Fish Hatchery and Dexter National Fish Hatchery and Technology Center (or other appropriate facilities). Larval razorback sucker (ca. Aswim-up@ stage) will be transferred to the MSB rearing facility with handling and transportation following existing U. S. Fish and Wildlife Service protocols. Growth and survival will be tracked during the rearing tenure at MSB. Personnel from CRFP-GJ will determine when it is appropriate to transfer larval razorback sucker from the interim MSB holding facilities to Ojo Amarillo and Avocet ponds (presumably May to June). This transfer and disposition of larvae will be determined and coordinated by CRFP-GJ with the assistance of MSB personnel.

Products:

A draft report assessing the success of the 2003 razorback sucker interim holding facilities will be prepared and distributed by 31 March 2004. That report will include information on the different stocks of larval razorback sucker holding facility success. Upon receipt of written comments, that report will be finalized and disseminated to members of the San Juan River Biology Committee by 1 June 2004. An electronic spreadsheet containing information from the project will also be submitted in accordance with the aforementioned schedule. Voucher series of fish collected from this study will be curated in the Division of Fishes, Museum of Southwestern Biology (MSB), Department of Biology, at the University of New Mexico.

Budget FY-2003:

Razorback sucker rearing and system maintenance (FY 2003):

Personnel		
Laboratory Research Associate (20 staff-days) (system management, disease control, feeding, supervision)	$	6,000
Laboratory Technician (23 staff-days) (feeding, cleaning, specimen care)	$	4,500
Subtotal	$	10,500
Travel and per diem		
Travel and per diem (acquiring and stocking fish; attending meetings)	$	2,000
Shipping supplies and costs (for specimens)	$	500
Subtotal	$	2,500
Equipment and Supplies		
Larval fish food	$	500
Miscellaneous supplies (for rearing system)	$	1,725
Subtotal	$	2,225
Total	$	15,225
Administrative Overhead	$	2,285
TOTAL	**$**	**17,510**

Out-year funding (based on 5% increases):

Fiscal Year 2001	$	13,800
Fiscal Year 2002 *	$ *	52,325
Fiscal Year 2003	$	17,510
Fiscal Year 2004	$	18,400
Fiscal Year 2005	$	19,305
Fiscal Year 2006	$	20,424
Fiscal Year 2007	$	21,275

This total included cost for both rearing/maintenance and system construction costs. Subsequent budgets (2003-2007) are based on FY 2002 rearing and maintenance costs of $16,675 [$14,500 + $ 2,175 IDC]).

Razorback Sucker Augmentation Ponds Limnological Study

Principle Investigator: Vincent Lamarra
Ecosystems Research Institute
975 South State Highway, Logan, UT 84321
(435) 752-2580 vincel@ecosysres.com

and

Principle Investigator: Ernie Teller
Bureau of Indian Affairs
304 North Auburn, Suite B
Farmington, New Mexico 87401-5838
(505) 3251864 eteller@bia.gov

Study Area:

The study area for this project involves the razorback sucker augmentation ponds recently built on the Navajo Indian Irrigation Project.

Background:

The San Juan River Recovery Implementation Plan has developed a razorback sucker augmentation plan. Under current conditions, the existing number of augmentation grow-out ponds is insufficient to meet this goal. Additional ponds maybe necessary. This proposal will determine the potential to increase the growth rate of larval, YOY and subadult razorback suckers within the augmentation ponds by maximizing the rate of secondary production (invertebrates) and thus increasing available food. This additional pond management may offset the need for some the anticipated additional facilities.

Objectives:

1.) Determine the Optimum Rate and Frequency of Pond Fertilization.

2.) Document the Alterations in Razorback Sucker Growth Rates.

3.) Develop a Grow-out pond Management Plan

Methods:

1.) Determine the Optimum Rate and Frequency of Pond Fertilization At the current time, there are nine grow-out ponds used in the razorback sucker augmentation program on the San Juan River. In order to achieve this objective, a subset of the available ponds will be fertilized with commercial grade nitrogen and phosphorous. These nutrients will be added at a N/P ratio of 15:1 by weight. Depending upon pH, the target concentration in the water will be 0.050 mg TP/l.

As currently envisioned, the experimental design would call for selected ponds to receive various frequencies of nutrient additions, with each addition targeting the same maximum concentration and N/P ratio.

Each control and treatment pond will be sampled approximately 11 times during the calender Year 2003. Parameters will include water quality grab samples (ortho-P; total-P; NH3; NO2-NO3; phytoplankton biomass (Chl a) and invertebrates (zooplankton and benthic) biomass. Field parameters such as pH, Dissolved Oxygen and temperature will also be measured.

2.) Document the Alterations in Razorback Sucker Growth Rates Prior to the onset of fertilization, the lengths and weights of a representative number of razorback suckers from each treatment pond will taken. Throughout the course of the study lengths and weights will be determined every two months, which, in total will allow the determination of the growth rates within individual treatments. All fish measured will be returned to the ponds.

3.) Develop a Grow-out pond Management Plan If necessary, the results of Objectives 1 and 2 above will lead to the development of a management plan which will quantify the cost, duration and frequency of pond fertilizations necessary to achieve optimum growth for razorback suckers

Products:

A final report will be produced as part of this investigation. This report will include the summation of the analytical water quality data as well as the biological parameters. As noted above, a recommendations section (Management Plan) will also be provided.

Budget FY-2003:

Category	Staff-Days		Cost
Personnel:			
Field	37	$	18,304
Data Analysis/Reporting	17	$	8,980
Subtotal	54	$	27,284
Expenses			
Travel	8	$	1,750
Supplies		$	2,035
Computer		$	350
Laboratory		$	15,790
Subtotal		$	19,925
Total		**$**	**47,209**

HYDROLOGY PROJECTS

Completion of the 3rd Generation San Juan River Basin Hydrology Model
San Juan River Basin Recovery Implementation Program - Hydrology Committee
Fiscal Year 2003 Project Proposal

Principal Investigator: Pat Page
Bureau of Reclamation
835 E. 2nd Avenue, Suite #300
Durango, CO 81301
(970) 385-6560 ppage@uc.usbr.gov

Background:

The 3rd Generation San Juan River Basin Hydrology Model (3rd Generation Hydrology Model) is being developed to rectify some known deficiencies in previous generation models and to model daily flows on the San Juan River mainstream to eliminate the disaggregation of monthly model flows completed previously with a model post-processor.

Study Area:

San Juan River Basin

Objectives:

1. **Complete the development of the 3rd Generation Hydrology Model** - The development of the 3rd Generation Hydrology Model will be 95% complete in FY2002. Due to unforseen data development needs and the lack of availability of staff and data, the reconfiguration of the model could not be entirely completed in FY2002 as previously anticipated (See Note 1). FY2003 technical work on the model would entail completing the following tasks: Data Systems Development (Task D); Extending Data Sets to 1929 (Task E); Extending Data Sets from 1993 to 1999 (Task F); and Daily Disaggregation (Task I) (See Note 2).

   Note 1: Previous budgets assumed that New Mexico would provide irrigation depletions, both historic and baseline. Reclamation is now having to compute these depletions from acreages and cropping patterns provided by New Mexico. The information is required for the development of climate data, data transformations to appropriate formats, and computation of Blaney-Criddle depletions.

   It was necessary to address and complete this work in FY2002. This came at the expense (both funding and staff time) of completing all of the work planned for FY2002. Hence the request for FY2003 funds represents funding and time expended due to addressing the unscheduled tasks in FY2002, not additional funding for previously planned work.

   Note 2: The task letters correspond to the task letters identified in the FY2001 and FY2002 Hydrology Committee Proposals.

2. **Develop complete and formal documentation of the 3rd Generation Hydrology Model** - Additional funding is being requested for documentation based upon discussions with the Hydrology Committee regarding the type and level of detail for the documentation of the model development and operating rules. The increased budget request for documentation work is a result of the Hydrology Committee's desire to have user's manuals and programmer's manuals, in addition to the previously requested formal model documentation. Although the two manuals will share certain elements, the audiences are different and therefore require additional work.

3. **Coordination and administration** - Reclamation will continue to prepare interim review documents, monthly status and budget reports, and presentations to brief the Hydrology Committee and interested parties on the development of the 3rd Generation Hydrology Model.

Products: Completed 3rd Generation Hydrology Model, with documentation

Budget FY-2003:

Objective	Staff days	Labor[1]	Travel	Equipment and supplies
Objective 1				
Personnel	21	15,000		
Travel - 4 trips at $500 per trip			2,000	
Equipment and supplies				1,100
Objective 2				
Personnel	19	12,400		
Travel				
Equipment and supplies				
Objective 3				
Personnel	36	22,000		
Travel - 4 trips at $500 per trip			2,000	
Equipment and supplies				
Sub-total	76	49,400	4,000	1,100
Total				**54,500**

[1] Labor costs calculated based on Denver USBR costs per day ($728), Durango USBR technical costs per day ($580), and Durango USBR coordination costs per day ($600). Each objective includes a combination of Denver and Durango USBR staff time.

Estimated Outyear Funding: The 3rd Generation Model is scheduled to be completed in June 2003.

Maintenance and Operation of the San Juan River Basin Hydrology Model
San Juan River Basin Recovery Implementation Program - Hydrology Committee
Fiscal Year 2003 Project Proposal

Principal Investigator: Pat Page
Bureau of Reclamation
835 E. 2nd Avenue, Suite #300
Durango, CO 81301
(970) 385-6560 ppage@uc.usbr.gov

Background:
The model will be made available to generate and analyze runs associated with Section 7 Consultations and/or special requests from the Biology or Coordination Committees related to the flow recommendations or other hydrological aspects of the Program. In order for the model to be available for such requests, the model and data must be maintained to adjust configurations, correct for errors, and evolve the data set forward through time. Additionally, Reclamation will coordinate and manage the hydrology-related tasks performed by the Hydrology Committee, including administering cooperative agreements and contracts with consultants, accounting for expenditures, developing and providing status reports, and coordinating work items to ensure work is completed as planned. Because the 3rd Generation model revision won't be completed until mid-FY2003, the estimated staff days and budget assume that only ½ of the fiscal year will be available for this work.

Study Area: San Juan River Basin

Objectives:
1. Maintain data to evolve the data set forward through time.

2. Maintain the model to adjust model configuration, methodologies, data, or assumptions.

3. Provide hardware and software support.

4. Implement Riverware upgrades and receive technical support.

5. Generate and analyze model runs associated with Section 7 consultations or special requests from the Biology and/or Coordination Committees.

6. Coordinate and manage the hydrology-related tasks performed by the Hydrology Committee, including administering cooperative agreements and contracts with consultants, accounting for expenditures, developing and providing status reports, and coordinating work items to ensure work is completed as planned.

Products:
1. Hydrological analysis of water development scenarios or other scenarios as requested by stakeholders or Program committees.

2. Monthly status reports showing work completed and funds expended will be provided to the Hydrology Committee. A report addressing the status of the model and documenting changes to it will be prepared and submitted to the Coordination Committee. Another report documenting hydrological conditions and Navajo Dam operations, and updating hydrological statistics for water year 2002 will also be prepared and submitted to the Coordination Committeee.

Budget FY-2003:

Objective	Staff days	Labor	Travel	Equipment and supplies
Objective 1				
Personnel	7	5,000		
Travel				
Equipment and supplies				
Objective 2				
Personnel	7	5,000		
Travel				
Equipment and supplies				
Objective 3				
Personnel	3	2,000		
Travel				
Equipment and supplies				
Objective 4				
Personnel				
Travel				
Equipment and supplies				2,500
Objective 5				
Personnel [1]	85	47,000		
Travel - 2 trips at $500 per trip			1,000	
Equipment and supplies				
Subtotal (technical work)				62,500
Objective 6				
Personnel	24	15,000		
Travel				
Equipment and supplies				
Sub-total (coordination)				15,000
Total				**$77,500**

Improve Stream Gaging and Flow Measurements
San Juan River Basin Recovery Implementation Program - Hydrology Committee
Fiscal Year 2003 Project Proposal

Principal Investigator: Pat Page
Bureau of Reclamation
835 E. 2nd Avenue, Suite #300
Durango, CO 81301
(970) 385-6560 ppage@uc.usbr.gov

Background:

There are five USGS streamflow gaging stations on the main stem of the San Juan River that are very important to the operation of the river and play an important role in the implementation of the flow recommendations. Stream gaging data on the San Juan River are needed to attempt to reliably develop and implement flow recommendations.

Study Area: San Juan River Basin in New Mexico

Objectives:

1. Provide funding to the USGS to take one additional flow measurement per month at the four San Juan River gages in New Mexico. (Note: Base cost for operation of the stations is paid for by non-Program funds.)

Products:

Improved flow measurement and more accurate gage readings.

Budget FY-2003:

Objective	Staff days	Labor	Travel	Equipment and supplies
Objective 1				
Personnel	36	20,300		
Travel			4,700	
Equipment and supplies				
Total				**$25,000**

Estimated Outyear Funding (Based on 5% allowance for inflation)

Fiscal Year 2004	$26,250
Fiscal Year 2005	$27,560
Fiscal Year 2006	$28,940
Fiscal Year 2007	$30,390

[1] Personnel time for model operation (Objective 5)includes 20 staff days for USBR Denver and 65 staff days (1/4 FTE) for USBR Western Colorado Area Office hydrologist/modeler. The staff days for the Western Colorado Area Office assumes a new employee would be involved in becoming familiar with the model and attending training. These staff days could be reduced if the work is completed by existing staff member who is familiar with the model.

Estimated Outyear Funding (Based on 5% allowance for inflation)

(Note: Outyear budget could be increased if additional hydrological Program duties are identified and assigned to the Reclamation modeler. The Hydrology Committee encourages Reclamation to staff this person in the Durango office.)

Fiscal Year 2004*	$110,250
Fiscal Year 2005**	$82,700
Fiscal Year 2006	$86,800
Fiscal Year 2007	$91,100

* FY2004 Budget includes model operation and maintenance work for entire year (not ½ year like FY2003) and assumes "new" hydrologist/modeler would still be in the learning process. Budget could be reduced if the work is completed by existing staff member who is familiar with the model.

**FY2005 Budget assumes no USBR Denver involvement and only one hydrologist/modeler is involved in the model operation and maintenance.

PROGRAM COORDINATION AND MANAGEMENT

Program Coordination
Fiscal Year 2003 Project Proposal

U.S. Fish and Wildlife Service
2105 Osuna NE
Albuquerque, New Mexico 87113
(505) 346-2525, ext. 152
Shirley_Mondy@fws.gov

Background:

The San Juan River Recovery Implementation Program (Program) is designed to simultaneously address endangered fish species recovery and development of water resources within the Basin. The Program includes representatives from not only Federal agencies, but also the States of Colorado and New Mexico, the Jicarilla Apache Nation, the Southern Ute Indian Tribe, the Ute Mountain Ute Tribe, the Navajo Nation and the water development interests, most of which have legal mandated responsibilities to the endangered fish and/or the water resources.

The Service is responsible for directing and coordinating the overall Program. As stated in the Program Document, the Service will appoint a Program Coordinator who will be responsible for overall Program coordination and dissemination of information about Program activities.

Tasks:

1. Coordinate the activities of the Biology, Hydrology and Coordination Committees.

2. See that approved recovery activities are implemented.

3. Disseminate information to involved state, federal, and tribal agencies.

4. Coordinate activities with the Upper Basin Recovery Implementation Program.

5. Coordinate and disseminate information on Program activities to the public through brochures, newsletters and/or the website.

6. Forward plans and recommendation to the Coordination Committee for review and approval.

7. Annual Work Plan:
   A. Work with the Biology and Hydrology Committees to identify and expedite individual projects that are needed to accomplish the long range plan for each of the recovery elements.
   B. Draft an annual work plan consisting of high priority individual projects, formulated within the available funding.
   C. Forward the work plan to the Coordination Committee for review and approval.

8. Maintain records showing distribution and expenditures of all annual and capital funds expended under the work plan by each funding source.

9. Maintain a list of interested parties and provide those parties with the meeting dates, times, locations, and agendas for Program meetings.

10. Provide draft and final summaries of meetings to committee members.

11. Report to the Coordination Committee at each meeting the status of Program activities and research projects, and accomplishment of milestones; report any problems with maintaining schedules and provide recommendations for solving those problems; implement the recommendations of the Coordination Committee to resolve scheduling problems.

12. Provide support materials for annual funding efforts with the U.S. Congress and state legislatures.

Budget:

Personnel		
Coordinator (½ time salary and benefits)	$	51,000
Program Assistant (salary and benefits)	$	42,200
Travel/Per Diem		
Coordinator		
(12 meetings, 1 trips to Denver)	$	2,500
Program Assistant		
(12 meetings, 1 trip to Denver)	$	2,500
Committee Meetings		
supplies	$	2,500
meeting space - $100/day Farmington - $300/day Durango	$	2,500
mailings	$	1,000
public notices - ($80/meeting)	$	1,000
Printing/publication	$	3,000
TOTAL	$	108,200
Administrative charge (20%)	$	21,640
Grand Total	**$**	**129,840**

Out year Costs (based on 5% inflation):

FY2004 - $136,332 FY2005 - $143,148 FY2006 - $150306

Program Management
Base Funding
Fiscal Year 2003 Project Proposal

U.S. Bureau of Reclamation
125 S. State St.
Salt Lake City, UT 84138-1147

Background:

Program Management funds support Reclamation staff involved in program administration. The funds are used for participation in the Biology and Hydrology Committees, including implementation of committee assignments not specifically identified in a scope of work, reporting, modeling, and coordination of water operations. Funds are also used for the administration of funding agreements, including issuing requisitions for program supplies, and the preparation and oversight of work conducted under cooperative agreements, contracts, and grants.

Management support for Capital fund projects, including technical oversight, budgeting, preparation of bids and funding agreements is covered within specific budgets for capital fund projects and are not included as part of this program management scope of work

Tasks - 2003

1. Administering and modifying, as needed, existing Intra-agency agreements for research and monitoring activities.

2. Administering and modifying, as needed, existing Cooperative Agreements with: the states of New Mexico, Utah, Colorado, and the University of New Mexico at Albuquerque for research and monitoring activities.

3. Transferring annual funds to the Bureau of Indian Affairs to augment their contributions to research programs.

4. Implementation of additional Cooperative Agreements or interagency acquisitions and requisitions as needed for base funded activities.

5. Support base funded research and monitoring activities and implement various assignments not identified within specific scopes of work as determined by Program Committees.

Budget FY-2003:

Personnel	$40,000
Travel/Per Diem	$10,000
TOTAL	**$50,000**

CAPITAL PROJECTS

Capital Improvement Program Management
San Juan River Recovery Program
Fiscal Year 2003 Project Proposal

Principal Investigator: Brent Uilenberg
Bureau of Reclamation
2764 Compass Dr., Suite 106
Grand Junction, CO 81506
(970) 248-0641 builenberg@uc.usbr.gov

Background:

The purpose of the San Juan Capital Improvements Program is to implement capital project which have been identified by the Program as necessary for the recovery of the endangered fish. As defined in Public Law 106-392 capital projects include "...planning, design, permitting or other compliance, pre-construction activities, construction, construction management, and replacement of facilities, and the acquisition of interests in land or water, as necessary to carry out the Recovery Implementation Programs".

Study Area:

San Juan River Basin

Objectives:

1. Coordinate the preparation of Federal budget requests.

2. Develop and manage cooperative agreement with the National Fish and Wildlife Foundation which provides the mechanism to utilize non-Federal cost share funds to implement capital projects.

3. Develop and manage contracts and agreements to accomplish construction and acquisition of capital projects.

4. Account for and provide capital project expenditure reports to the Coordination Committee.

5. Coordinate planning, design, permitting, pre-construction, construction and acquisition of capital projects.

Products:

Financial reports will be periodically provided to the Coordination Committee documenting the status of Federal appropriations and non-Federal cost sharing contributions.

Budget FY-2003:

Objective	Staff days	Labor	Travel	Equipment and supplies
Objective 1				
Personnel	10	5,000		
Travel				
Equipment and supplies				
Objective 2				
Personnel	15	7,500		
Travel - 2 trips to Denver at $500 per trip			1,000	
Equipment and supplies				0
Objective 3				
Personnel - 30 staff days @ $500 per day	30	15,000		
Travel - 5 trips to Denver at $500 per trip			2,500	
Equipment and supplies - communication and computer				2,000
Objective 4				
Personnel	10	5,000		
Travel - 2 trips to Denver at $500 per trip			1,000	
Equipment and supplies				0
Objective 5				
Personnel	90	45,000		
Travel - 10 trips to Denver at $500 per trip			5,000	
Equipment and supplies				2,000
Sub-total	155	77,500	9,500	4,000
Total				**91,000**

Construction of Public Service Company of New Mexico
Fish Passage Structure
Fiscal Year 2003 Project Proposal

Principal Investigator: Bob Norman
U.S. Bureau of Reclamation
2764 Compass Drive, Suite 106
Grand Junction, CO 81506
(970) 248-0634 rnorman@uc.usbr.gov

Study Area:

Public Service Company of New Mexico Diversion Dam is located at RM 166.6

Collections:

None.

Background:

The PNM Diversion Dam (see Figure 1) was constructed in 1971. The 3.25-foot high diversion dam (weir) is located on the San Juan River about 12 miles downstream of Farmington, New Mexico near the town of Fruitland at River Mile 166.6. Facilities at the diversion include a concrete weir, a series of screened intake structures, an intake channel, a settling channel, and a pump house.

A need has been identified by the San Juan River Basin Recovery Implementation Program (SJRRIP) to restore endangered fish passage upstream past the PNM Diversion Dam. The purpose of establishing fish passage would be to protect and recover native Colorado pikeminnow (*Ptychocheilus lucius)* and razorback sucker (*Xyrauchen texanus*) populations in the San Juan Basin while water development proceeds in compliance with all applicable Federal and State laws, including fulfillment of Federal trust responsibilities to the Southern Ute Indian Tribe, Ute Mountain Ute Tribe, Jicarilla Apache Nation and the Navajo Nation. In addition, other native fish species would benefit from restored passage.

The fish passageway will extend the range of these two native fishes upstream about 50 miles into historical habitat and may allow Colorado pikeminnow to naturally re-colonize these upstream reaches.

A fish trapping facility located at the upper end or forebay of the fishway allows researchers to sort, examine, and count fish and remove nonnative fish from the system.

Objectives:

1) Construct fish passage facility and low flow barrier.

End Products:

1) Fish passage facility

Methods:

A construction contract award is anticipated in mid- to late-summer 2002. The award of the contract is contingent on finding a willing owner of the facility and finalization of construction access agreements. If those agreements are not finalized by May 24, 2002. It may be necessary to delay the construction award to October or November 2002. The fish passage facility is scheduled to be operational by the spring of 2003. The Navajo Nation will perform the long-term operation of the passageway and Public Service Company of New Mexico will perform maintenance.

Budget and Schedule			
	FY2002	FY2003	Total
Construction	1,500,000		1,500,000
Construction inspection		125,000	125,000
	1,500,000	**125,000**	1,625,000

References:

None.

Operation of Public Service Company of New Mexico
Fish Passage Structure
Fiscal Year 2002 Project Proposal

Principal Investigator: Bob Krakow
Navajo Indian Irrigation Project
204 North Auburn, Suite B, Farmington, NM 87401
505-325-1864

Study Area:

Public Service Company of New Mexico Diversion Dam is located at RM 166.6

Collections:

The fish trap at the upstream end of the fish passage provides the ability to capture all fish that use the passageway. Specimens collected will be inspected to determine if any rare fishes (Colorado pikeminnow, roundtail chub, and razorback sucker) are present in the trap. All identifiable rare fish and all large-bodied native fish (i.e., flannelmouth and bluehead suckers) will be released. All other specimens will be removed from the river.

Background:

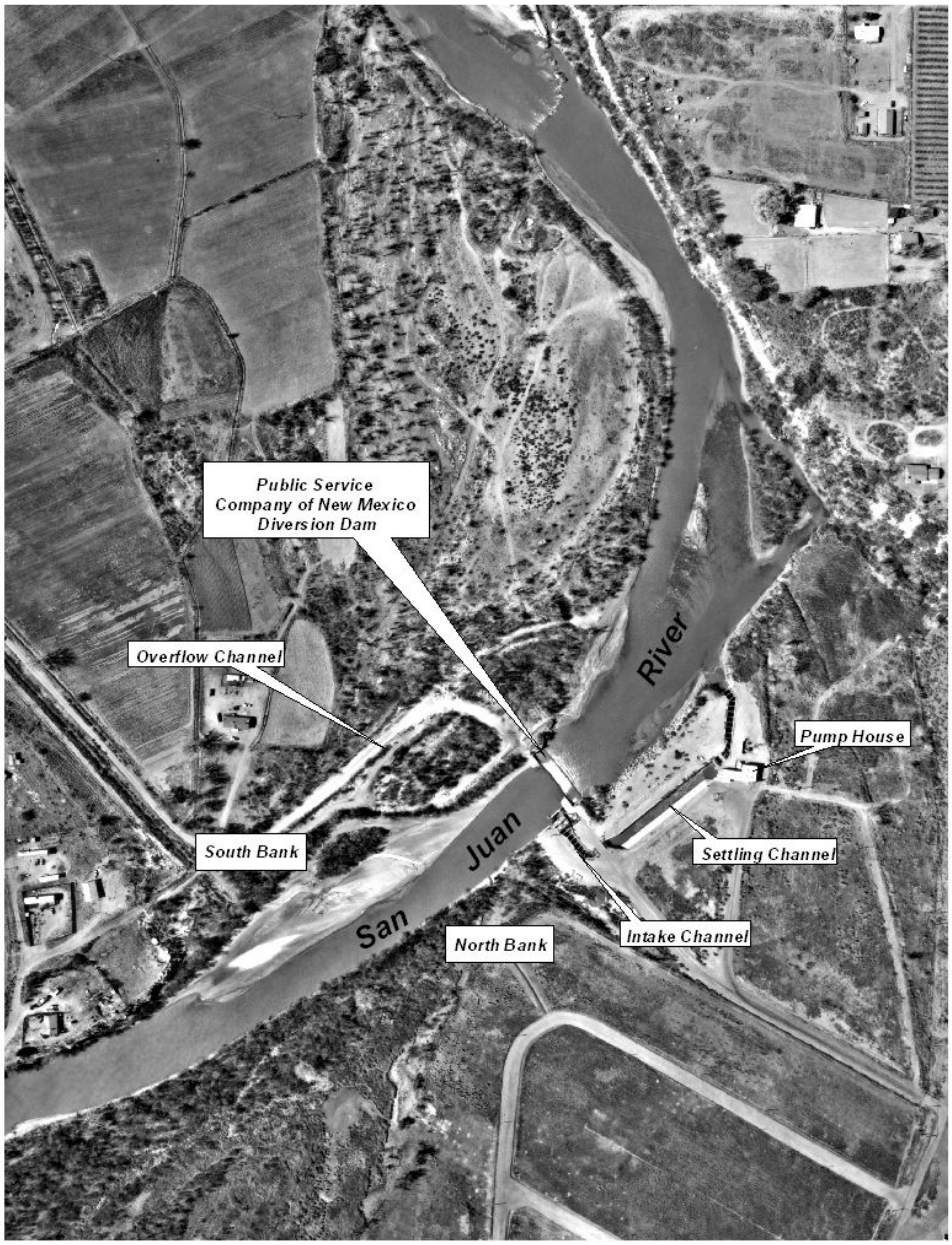
The PNM Diversion Dam (see Figure 1) was constructed in 1971. The 3.25-foot high diversion dam (weir) is located on the San Juan River about 12 miles downstream of Farmington, New Mexico near the town of Fruitland at River Mile 166.6. Facilities at the diversion include a concrete weir, a series of screened intake structures, an intake channel, a settling channel, and a pump house.

Water flows over the dam into a stilling basin created by a concrete apron. The stilling basin is the width of the river. The presence of the dam and the basin creates a barrier to fish moving upstream. As flows increase, the difference in the upstream and downstream water levels is reduced. Although water levels are reduced, water velocities increase and the weir provides an impediment to upstream fish movement. Recovery studies conducted as part of the SJRRIP have shown that some fish are able to move upstream past the weir but their specific method of movement is not known and the number of fish discouraged from upstream movement by the presence of the weir is also unknown. One possible method of upstream movement could occur during high river flows. When the flow in the San Juan River is above 7,000 cfs, some of the flow goes around the dam making it possible for fish to go around the dam at these higher flows.

A 4-foot by 6-foot sluiceway in the weir located on the north side of the river, is used to sluice the inlet structure of sediment. Normal sluice gate operations have the sluice gate open between 8 and 12 inches. Trash racks and isolation gates are located at the point of diversion. A concrete settling channel about 490 feet long conveys river water to the pump house or returns it to the river. Diverted water moves through traveling screens to three pumps, together they are capable of pumping a maximum of 17,000 gallons per minute (37 cfs) to a 110-acre storage reservoir

(Figure 2). From the storage reservoir, the water is pumped to San Juan Generating Station (SJGS).

The facility provides an average of approximately 1 million gallons of water per hour (24,200 acre-feet per year) to PNM for cooling operations for the SJGS (Tetra-Tech 2000).



A need has been identified by the San Juan River Basin Recovery Implementation Program (SJRRIP) to restore endangered fish passage upstream past the PNM Diversion Dam. The purpose of establishing fish passage would be to protect and recover native Colorado pikeminnow (*Ptychocheilus lucius)* and razorback sucker (*Xyrauchen texanus*) populations in the

San Juan Basin while water development proceeds in compliance with all applicable Federal and State laws, including fulfillment of Federal trust responsibilities to the Southern Ute Indian Tribe, Ute Mountain Ute Tribe, Jicarilla Apache Nation and the Navajo Nation. In addition, other native fish species would benefit from restored passage.

The fish passageway will extend the range of these two native fishes upstream about 50 miles into historical habitat and may allow Colorado pikeminnow to naturally re-colonize these upstream reaches.

A fish trapping facility located at the upper end or forebay of the fishway allows researchers to sort, examine, and count fish and remove nonnative fish from the system.

Objectives

1) Determine the use of the fish passageway by juvenile and adult native and nonnative fishes.
2) Identify any Colorado pikeminnow congregations that may be related to the spawning period in the San Juan River.
3) Maintain the facility in a manner that assures long-term benefit.

End Products
1. Definitive data on passage--number of species; numbers per species; seasonal use and distribution by species.
2. Well maintained and operable fish passage facility.

Methods:

Working with the Program, Reclamation will contract with the Navajo Nation to perform the long-term operation and maintenance of the passageway. Work performed by the Nation is grouped in 2 general areas, operation and maintenance.

Fish and Wildlife Service personnel will provide necessary fish passageway training. Training will be provided in Grand Junction, Colorado at the Redlands Fish Passage on the Gunnison River. The training will assure the follow proficiencies:
    1. Proper fish handling skills.
    2. Species identification
    3. PIT Tagging skills

Operation
1. Operate the fish trap and passage way from April 1 through October 31 each year.
2. Passage is visited once a day to check trap, sort fish, and remove trash as needed. Steps are as follows:
    1. Lower water in trap
    2. Collect fish in nets and remove from trap

3. Sort fish by native and non-native species (dispose of non-native with exception of trout species) (Potentially provide channel catfish to non-profit organization like school, senior center, etc.).
4. Enumerate and record all fish 4" in length or longer.
5. Check Colorado pikeminnow and razorback sucker for presence of a PIT tag.
6. If tag is present record number, tag fish if no tag is found.
7. Weigh and measure each Colorado pikeminnow and razorback sucker (use total length in mm, weight in grams).
8. Return all native species to the river via the fish return pipe.
9. Raise water in trap.

3. Crews checking the fish trap are also responsible for periodic cleaning of riverborne sediment in the fish trap that usually builds up during runoff.
4. Daily cleaning of surface and submerged trash, debris, and riverborne algae from the trash racks and bar screens in the forebay of the fish passageway, and aluminum conduit screens in the fish trap. The amount of algae, debris, trash, and sediment that accumulates daily at this site is seasonally variable, depending upon flow magnitude and water volume during the water year.
5. Analyze and evaluate data and prepare annual progress report.
6. Prepare draft and final report.

Maintenance

1) Maintain the fish passage facility as necessary. Maintenance will include inspection of facilities for items that need to be repaired. Painting as necessary to control corrosion. Lubrication of moving equipment. Checking fluid levels in gear boxes and cooling radiators, if any.
2) During the first 2 years of operation representatives from the Navajo Nation, Reclamation, and FWS will inspect the facility to identify any design deficiencies and maintenance requirements.
3) After the first 2 years of operation, representatives from the Navajo Nation, Reclamation and the FWS will perform an inspection every 3 years.
4) In the event of a significant flood event, representatives from the Navajo Nation will notify Reclamation, BIA and the FWS and all parties will inspect the facility for damage.

Deliverables/Schedule:

1) Fish number will be recorded daily and a monthly fish passage report shall be submitted to the U.S. Fish and Wildlife Service by the 15th of each following month including time and date each time the trap was checked, number of species, and lengths, weights and PIT Tag numbers of each endangered fish.
2) Analyze and evaluate data and prepare annual progress report.
3) Prepare draft and final report.

Budget

Training	
Travel	1,000
Labor	2,000
First Year Start-Up Supplies	
Dip nets	50
Rubber boots	75
PIT Tags	500
PIT Tag wand reader	2,000
Fish measuring board	75
Weighing scale	125
High pressure pump for cleaning trap	750
Crowding Screen	500
Misc hand tools	325
Fish Passage Operation	
Labor	20,000
Supplies	4,000
Fish Passage Maintenance	
Labor	2,000
Equipment	1,600
Supplies	500
Facility Inspection	
FWS - personnel costs	800
FWS - travel costs	150
Reclamation - personnel costs (inspection and inspection report)	2,400
Reclamation - travel	150
Report Preparation	
Labor	3,000
Total	**42,000**

References:

Burdick, B. D. 2001. Upper Colorado River Recovery Implementation Program 2001 Scope of Work for Evaluation of Redlands Fish Passage structure

Razorback Sucker Grow Out Ponds
San Juan River Basin Recovery Implementation Program
Fiscal Year 2003 Project Proposal

Recommended by Hydrology Committee

Background:

The Biology Committee has identified the need for at least 9 more surface acres of grow out ponds for the razorback suckers. As of July, 2002, specific plans to obtain the additional acreage have not been developed; however, proposals for additional pond acreage are expected to be developed by the Biology Committee, private landowners or governmental entities in time for the ponds to be utilized in the spring of 2003. These new ponds will be available if construction funding is provided from the FY 2003 budget.

The purpose of this proposal is to "allocate" construction funds from the FY 2003 budget in the event that additional grow out ponds are identified.

New grow out ponds that utilize these funds must be reviewed and approved by appropriate entities (USFWS and SJRIP Committees). Also, any lease and repayment agreements must be completed prior to the providing funding from the FY2003 budget. No pre-approval of ponds is implied or suggested through this proposal.

Study Area:

San Juan River Basin in New Mexico

Objective:

Allocate funds from the FY2003 budget, in the event that suitable razorback sucker grow out ponds are identified, reviewed, approved and contracted during the FY 2003 budget period.

Products:

Allows the timely acquisition and/or construction of razorback sucker grow out ponds.

Budget FY-2003:

The amount of construction funds recommended to be allocated in the FY2003 budget is up to $405,000. The most recent grow out ponds constructed by the SJRIP were on NIIP, the cost was about $27,000 per acre. At least 9 acres of grow out ponds are needed, but if available 15 acres could be used. The maximum cost would be 15 acres times $27,000 which is $405,000